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SUGAR, MEASURED AS LUMP SUGAR, LOST IN THE URINE BY UNTREATED DIABETIC PATIENTS.

Case No. 295	Case No. 1147	Case No. 653
A Severe Diabetic	A Moderate Diabetic	A Mild Diabetic
680 grams a day	300 grams a day	174 grams a day
546 pounds (1½ barrels) a year	240 pounds (⅔ barrel) a year	140 pounds (⅔ barrel) a year

The Number of Diabetic Patients in the United States is not Far from Half a Million.

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A

DIABETIC MANUAL

FOR THE

MUTUAL USE OF DOCTOR AND PATIENT

BY

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Illustrated

LEA & FEBIGER
PHILADELPHIA AND NEW YORK
1918

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TO

THE DIABETIC PATIENTS

OF

THE UNITED STATES OF AMERICA

UPON EACH ONE OF YOU

REST RESPONSIBILITIES OF SAVING FOOD

BOTH BY

YOUR OWN EXAMPLE, SHOWN IN THE CAREFUL TREATMENT

OF YOURSELF, AND BY YOUR INSTRUCTION OF

THOSE ABOUT YOU IN FOOD VALUES

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PREFACE.

For one diabetic patient who knows too much about his disease there are unquestionably ninety-nine who know too little. That is the reason for this little book, in which I have tried to give in schematic form the modern conception of diabetes and its treatment. The presentation is radically elementary, in the hope that a book of this nature, written in the light of recent discoveries in laboratory and clinic, will be a help to the general practitioner and useful as a text-book for his patients, thereby securing their intelligent coöperation, and thus enabling him to raise the standard of diabetic treatment. These pages emphatically cannot take the place of a competent physician, but I trust that they will supply sound instruction in combating a disease which is statistically four times as prevalent in Boston today as in 1890, and twice as prevalent in the registration area of the United States as in 1900.

The manual is arranged in four parts. Part I might be called a diabetic primer. It gives in untechnical language a rapid survey of the whole subject, sketching fundamental conceptions and emphasizing their most important applications. Part II retraces with more detail and in more technical language the general field, and contains an outline of the treatment of the severer diabetic, already elsewhere described for physicians in *The Treatment of Diabetes Mellitus*, recently published for the author by Messrs. Lea & Febiger. The

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technic of becoming sugar-free and remaining so is described in detail. Part III contains diet tables and recipes which the author has found valuable in his daily practice. In Part IV are described the simplest tests which a physician can employ for the estimation of sugar and acid bodies in the urine, the sugar in the blood and the carbon dioxide in the alveolar air. These tests can be readily acquired. I have been teaching them for several months to my most experienced nurses, and if druggists should master them I am sure they would be of great service to their respective localities.

Tables and, to a lesser extent, the text show repetition. This is with design, and I trust will prove to be with profit.

In the preparation of the following pages I am indebted directly or indirectly to nearly all who helped me in the compilation of *The Treatment of Diabetes Mellitus*, but more than ever I am under obligation to Professor Walter R. Miles for his valuable counsel and continuous aid.

I am especially grateful to my publishers because of their continued courtesies, and to my secretary, Miss Helen Leonard, upon whom has devolved the final revision of the proof.

E. P. J.

BOSTON, 1918.

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PART I.

INTRODUCTION TO DIABETIC TREATMENT.

CHAPTER I.

GENERAL CONSIDERATIONS.

It is perfectly true that diabetes is a chronic disease, but, unlike rheumatism and cancer, it is painless; unlike tuberculosis, it is clean and not contagious, and in contrast to many diseases of the skin it is not unsightly. Moreover, it is susceptible to treatment, and the downward course of a patient can usually be promptly checked. Treatment, however, is by diet and not by drugs, and the patients who know the most, conditions being equal, can live the longest. There is no disease in which an understanding by the patient of the methods of treatment avails as much. Brains count. But knowledge alone will not save the diabetic. This is a disease which tests the character of the patient, and for success in withstanding it, in addition to wisdom, he must possess honesty, self-control and courage. Already 33 of my patients have lived longer than would have been expected of them had they been normal, healthy people. For the diabetic this is a demonstration and a challenge.

The underlying cause for diabetes is usually considered to be a derangement in one of the functions of the pancreas. This is a gland, in animals known as the sweetbread, which lies behind the stomach near the liver. It discharges into the bowel the most important digestive juice of any gland in the body, and this juice is capable of digesting all kinds of

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food. Strangely enough this digestive action of the pancreas remains undisturbed in diabetes. The fault with the pancreas in diabetes concerns that function of the gland which regulates the body's use of the sugar formed from the food. This function appears to reside in groups of cells distributed throughout the pancreas and called the "islands of Langerhans." When these cells have been found to be diseased a history of diabetes has been usually demonstrable. These groups of cells probably manufacture a special internal secretion which is discharged into the blood. Experimentally, with animals, it is easy to produce diabetes by simply removing a large portion of the pancreas, and the severity of the diabetes so produced is proportional to the amount of the gland removed. If the diabetic patient could secure a new pancreatic gland he would be cured. As yet all attempts to successfully treat diabetes by feeding patients the healthy pancreatic glands of animals, by the use of extracts made from the gland or by grafting portions of a healthy gland under the skin have failed. Nevertheless, I expect some measure of success will be eventually achieved along these lines, and I hope within the next decade.

Granted that there is a natural tendency to diabetes in certain individuals, this develops into the actual disease most commonly when the body has been overfed. More than 40 per cent. of my diabetic cases have been too fat, and in a recent series of 100 diabetic cases I found obesity to have existed in 57 of them. The average number of pounds overweight for a series of 457 diabetic patients for different ages is shown in Table 1.

TABLE 1.—OVERWEIGHT USUALLY PRECEDES DIABETES.

Age in years.	Number of cases.	Average number of pounds overweight.
12 to 24	38	3
25 to 29	27	54
30 to 39	72	23
39 and over	320	37

Lack of exercise is of course a factor in producing the condition of overweight, and thus an indirect cause of diabetes.

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Disuse of the muscles, however, is itself a direct factor, for it is largely in these that the sugar formed from the food is consumed. That man who gives up an active outdoor life and is promoted to an office chair by this change becomes a promising candidate for diabetes. If the overfeeding has been in the form of sugar, predisposition to diabetes is greater. There is real danger in the candy habit. It is possible that the recent increase in the quantity of sugar consumed per capita in the United States has increased our number of diabetics. Between 1800 and 1810 the average consumption of sugar by each individual in the United States was 11 pounds a year, but between 1910 and 1917 it was 73 pounds, and Mr. Hoover is credited in the daily papers for September, 1917, with showing this figure for 1916 to be 90 pounds.

No other condition rivals obesity in importance as a forerunner of diabetes, but the strenuous life is probably of some significance. This appears reasonable, for it has been shown that medical students, after three-hour written examinations upon which their promotion for a year depends, often show sugar in the urine immediately thereafter, and it may not be a chance coincidence that within the last year I had at one time under active treatment for diabetes three children who had recently led their respective classes at school. My most recent illustration of this is another child, Case No. 1380, who came to the office showing 6.2 per cent. of sugar. She had skipped two classes at school, and the following summer had eaten even more than her habitually large amount of sweets and candy.

In the presence of an infectious disease, for example tonsillitis, an existing diabetes grows worse; but it is yet to be demonstrated that diabetes frequently occurs as the result of an infection.

Of my cases, only 21 per cent. show a history of diabetes in their families, *i. e.*, that the disease has been present in parents, brothers or sisters. Hereditary cases in my experience are usually mild, and I am in hopes that with the avoidance of obesity and with moderation in the use of sweet food the children of diabetics may be no more liable to the disease than other children. Particularly should the urines of such

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individuals be carefully examined when conditions arise which would favor the development of diabetes. It would be a great mistake to consider the diet alone of importance. Mental relaxation and physical exercise should be promoted. If we are to bring about a decrease of diabetes in the community it will be with measures such as these. Every agency which promotes health and physical development tends to prevent an outbreak of the diabetic tendency. "It is easier to keep well than to get well." (Greeley.)

The disease sugar diabetes, usually known by its Latin name, "diabetes mellitus," is revealed when sugar is found in the urine. The development of the disease may be gradual or acute, and with or without symptoms. It is fortunate that the disease can be so readily discovered, for unlike many diseases whose beginnings can be only detected by specialists or disclosed by the help of elaborate and expensive methods such as the Roentgen rays, diabetes can be easily and promptly recognized by any physician who will be on the watch for it and will examine the urine of his patient for sugar. The subsequent behavior of the disease and the effect of treatment are also easily followed by simple examinations, and herein the diabetic has a great advantage over many another patient.

The sugar in the urine of diabetic patients is derived from the food, and chiefly from that consumed within the preceding twenty-four hours. The effects of a meal begin to show by an increase of the sugar in the blood or by the appearance of sugar in the urine within ten minutes. Most of the sugar in the urine comes from carbohydrate (sugar and starch), but in extremely severe cases as much as 60 per cent. of the protein (examples of which are lean of meat and fish, white of egg and curd of milk) in the diet may change to sugar. No sugar is formed from fat, but if a diabetic eats too much fat he utilizes the carbohydrate and protein of the diet less well.

Improvement in diabetes takes place when the urine is kept free from sugar. The annoying symptoms of the untreated diabetic then vanish. Under such conditions the power of the pancreas to assimilate carbohydrate is increased.

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Conversely, if the urine is not free from sugar the patient is generally only holding his own, or more likely is growing worse. Professor Naunyn, who for a generation was perhaps the leading specialist in diabetes, observed that even severe cases if treated early did well, whereas mild cases if neglected usually did poorly.

In what follows an attempt will be made to show how to treat the disease, and since success of treatment is most easily attained by the selection of a diet which will keep the urine sugar-free, detailed advice along dietetic lines will be given. The responsibility for maintaining this favorable state must rest in large measure upon the patient himself. He must learn what diet is best for him and must constantly control his condition by the examination of his urine. He is his own nurse, doctor's assistant and chemist. If he tries to be his own doctor he will come to grief. To acquire the requisite knowledge for this triple vocation requires diligent study, but the prize offered is worth while, for it is nothing less than life itself.

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CHAPTER II.

THE TREATMENT OF MILD CASES.

THE present treatment of mild cases of diabetes in many respects resembles the form of treatment generally employed for all cases of whatever severity prior to 1913. It is simple and can be made successful. Patients who faithfully follow the advice given seldom suffer any material annoyance from the disease. Even after a decade the disease makes little or no progress. How readily symptoms of thirst, frequent urination and loss of weight yield to treatment is evidenced

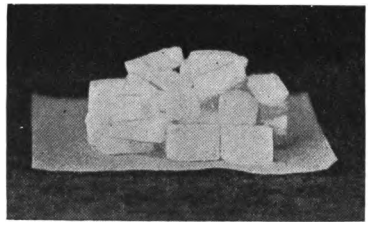

FIG. 1.—The quantity of sugar daily lost in the urine by a mild but untreated diabetic patient.

by the useful careers of several of my genial, fat, doctor-patients. Such a one is Case No. 653, who came to me at the age of fifty-three years, having found 5.8 per cent. of sugar in the urine. The volume of urine in the entire twenty-four hours was 3000 c.c. (100 ounces or a little over 3 quarts). The total quantity of sugar therefore which he lost and thus wasted in the urine each day was (3000 c.c. $\times$ 0.058) 174 grams or ($\frac{174}{30}$) 5.8 ounces. Fig. 1 is an illustration of this quantity of sugar, shown as lumps of sugar, and is inserted here to make it plain why any untreated diabetic will eat more than a normal individual and yet not be satisfied and will

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easily lose weight. It also makes it evident why the untreated diabetic is a food spendthrift.

According to his own story this doctor had always eaten freely; candy was the rule rather than the exception in his house, and the hospitable home was renowned for its cooks. At the age of fifty-three years his weight was 254 pounds, which for his height represented 88 pounds overweight. Contrary to the usual rule he engaged in athletics, but only for a part of the year. Despite the high percentage of sugar I could remove worries at once and declare the outlook favorable because of the early detection of the disease and the obviously exciting but remediable causes.

Treatment was simple. First of all daily instead of intermittent exercise was encouraged and temporarily less exacting work. The diet was likewise rearranged. Like all diabetics of whatever severity he was allowed as much as desired, but controlled by common-sense, of the following articles: Water; clear, thin broths; coffee; tea; cocoa shells; cracked cocoa. These liquids contain practically no nourishment, and no allowance need be made for the food content. The balance of the diet was made out for him in rather more definite terms. Thus he was given for breakfast two eggs and four strips of bacon, and at the other two meals a single portion of meat or fish of moderate size. Here again the diet resembles in quantity that prescribed for severer cases, for all excesses are avoided. The remainder of the menu was made up of articles selected from the following lists without limitations as to quantity or quality, though he was restricted to the use of a single vegetable from the 20 per cent. group at a meal. (See Table 2; also p. 25.)

It will be seen that the choice of diet was liberal. It contained nearly everything except sugar, bread, bread products and cereals, desserts, milk and milk products. Even potato, in the 20 per cent. group, and fruits were allowed freely.

What was the result of this treatment upon our fat doctor, Case No. 653? The next specimen of urine contained 1 per cent. of sugar, and as the quantity of urine was 2040 c.c., the total excretion was 20 grams, or two-thirds of an ounce. Nine days later the percentage of sugar was 0.4 and the

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amount 5 grams, and a week later the urine was sugar-free. It has remained so since. The weight of the patient is now 213 pounds, a reduction of 41 pounds. Except for the addition of cream and butter to the above diet no change in it was made for some months; later it was gradually increased, and

TABLE 2.—FOODS CLASSIFIED ACCORDING TO THE PERCENTAGE CONTENT OF CARBOHYDRATE.

Vegetables (fresh or canned).

5 per cent.	**10 per cent.**	**15 per cent.**	**20 per cent.**
Lettuce	Pumpkin	Green peas	Potatoes
Cucumbers	Turnip	Artichokes	Shell beans
Spinach	Kohl-rabi	Parsnips	Baked beans
Asparagus	Squash	Canned lima beans	Green corn
Rhubarb	Beets		Boiled rice
Endive	Carrots		Boiled macaroni
Marrow	Onions		
Sorrel	Mushrooms		
Sauerkraut			
Beet greens			
Dandelion greens			
Swiss chard			
Celery			
Tomatoes			
Brussels sprouts			
Water cress			
Sea kale			
Okra			
Cauliflower			
Egg plant			
Cabbage			
Radishes			
Leeks			
String beans			
Broccoli			

	Fruits.		
Ripe olives (20 per cent. fat)	Oranges	Apples	Plums
Grape fruit	Cranberries	Pears	Bananas
Lemons	Strawberries	Apricots	Prunes
	Blackberries	Blueberries	
	Gooseberries	Cherries	
	Peaches	Currants	
	Pineapple	Raspberries	
	Watermelon	Huckleberries	

	Nuts.		
Butternuts	Brazil nuts	Almonds	Peanuts
Pignolias	Black walnuts	Walnuts (English)	**40 per cent.**
	Hickory	Beechnuts	Chestnuts
	Pecans	Pistachios	
	Filberts	Pine nuts	

Miscellaneous.
Unsweetened and unspiced pickle, clams, oysters, scallops, liver, fish roe.

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in September, 1917, in answer to my inquiry, the patient summarized for me his diet, and wrote as follows:

BREAKFAST.—Oatmeal with cream, 2 eggs, hash (alternative, fish or fish balls), fruit of any kind and potatoes.

LUNCH.—Cold meat (alternative, hash, creamed salt fish, sometimes meat pie made with pastry or macaroni), potatoes and fruit.

DINNER.—Any kind of soup except baked-bean soup, any kind of meat or fish, all kinds of vegetables and salads. For dessert generally fruit, now and then a custard made with salt and no sugar or an apple pie made without sugar.

"When at home I very rarely eat any bread of any kind. If out to dinner will eat bread, occasionally a couple of griddle cakes without syrup or sugar, and now and then a doughnut. If at a dinner party I drink whisky or wines. Have not tasted a cocktail or any kind of malt liquor for four years. Average consumption of alcoholic drinks would be about one ounce a week. Have not wilfully eaten anything prepared with sugar for four years. Have used 100 saccharine pills in thirty-two months. I cannot say just how many days I have been forced to stay away from business, but my trouble has not interfered with my daily life."

The treatment which this patient has undergone has been the treatment of most cases of diabetes of whatever type in the past, but with this notable difference in result: That upon it this patient, a mild case, has been able to keep sugar-free. By means of such a diet even severe cases often live for a year or two and moderately severe cases for more than half a decade. This still remains the diet best adapted to those moderately severe and severe diabetics who are ignorant or unwilling to make an effort to improve. But for the intelligent patient with moderately severe or severe diabetes who is honest, energetic and has self-control, later pages will show how his span of life can be lengthened, his comfort maintained and his efficiency in large part preserved.

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CHAPTER III.

THE IMPROVEMENT IN THE TREATMENT.

One often hears the remark that patients with diabetes live for years with little inconvenience to themselves, even though strict rules of diet are neglected. This may be a consoling thought to some weak-willed patient, but if the average diabetic yields to such seductive advice the probability is overwhelming that he will later pay the penalty. Furthermore, such statements are not true. Their origin lies in the favorable course of the large number of mild cases of diabetes, but just as it is a serious blunder in war to disparage the strength of the enemy, so it is in diabetes. How serious in the past diabetes has really been, and at the same time how much the methods of treatment have improved during the recent years, is better shown by the statistics for diabetes of the Massachusetts General Hospital than in any other way I know. These statistics are incorporated in Table 3. No student of medicine, practitioner, patient or investigator can fail to be impressed by them or to gather hope for the future from this progressive improvement. It is gratifying that this advance has come through hard work and not by chance, and that multitudes of scientific men and women have shared in it. I believe everyone will agree that Dr. Frederick M. Allen, of the Rockefeller Institute for Medical Research, has contributed most of all toward bringing this improvement about.

Table 3.—The Recent Improvement in Diabetic Treatment as Shown by the Statistics of the Massachusetts General Hospital.

Period.	Number of cases.	Mortality during hospital stay. Number of deaths.	Per cent.
1824 to 1898	172	47	27
1898 to 1914	284	80	28
1914	51	8	16
1915	89	11	12
1916	103	8	8
1917	105	6	6

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During the first seventy-four years subsequent to the opening of the hospital, of every 100 diabetic patients who entered the hospital 27 died within its walls. Even in the succeeding period of sixteen years, which closed with the year 1913, the mortality remained as high. Examination of the next few years ending with the present shows a constant lowering of the mortality, so that in 1917 it was less than one-fourth of what it was a few years ago. A reduction in mortality from 28 per cent. to 6 per cent. is no mean achievement.

I consider these figures far more valuable than my own, which follow, in showing the improvement in diabetic treatment, because in a large hospital the cases cannot be selected, and the treatment is carried out by many rather than by a single physician. Confirmatory of the Massachusetts General Hospital statistics, however, are those of my own cases treated at the Corey Hill Hospital and the New England Deaconess Hospital beginning with January, 1913, as shown in Table 4.

I attribute the improvement in my own series of cases to (1) the introduction of the newer methods of treatment inaugurated by Dr. Allen; (2) improved methods for the estimation of acid poisoning—that arch enemy of the diabetic; (3) the preliminary omission of fat prior to any change in diet; (4) the omission of alkalis.

TABLE 4.—MORTALITY AMONG AUTHOR'S CASES TREATED AT THE COREY HILL AND NEW ENGLAND DEACONESS HOSPITALS, JANUARY, 1913 TO JANUARY, 1918.

Year.	Number of cases.	Mortality during hospital stay.	
		Number of deaths.	Per cent.
1913	43	4	9
1914	60	3	5
1915	109	6	6
1916	164	8	5
1917	181	4	2

No disease is known to me whose statistics during the last three years show an advance in treatment comparable to that demonstrated in Tables 3 and 4. The chief explanation for the lessening of hospital diabetic mortality is undoub-

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tedly the improved methods of recognition and of treatment of diabetic acid intoxication, which formerly used so often to culminate in diabetic coma and death. This has been one of the outgrowths of the introduction of newer methods of treatment, of which fasting is the most important.

The need of further improvement in the treatment of severe diabetes still exists. This fact must be courageously faced. The prevention of acid intoxication is an important victory yet to be won. This will be borne in mind in all that follows about treatment, but a summary of the nature of acid poisoning, its cause and the measures now available to combat it will be found beginning on page 103.

All too often in recent years it has been felt that if the urine of a patient were rendered sugar-free by fasting the treatment of the diabetic ended; in reality it is hardly begun. The problem of diabetic treatment varies so much that it is impracticable to give dogmatic rules, though I often do so (1) to make precise in my own mind my ideas upon treatment and (2) to learn by experience how these rules can be advantageously altered. The disease covers so long a period of time that it is really necessary for the moderately severe and severe diabetic patient to be familiar with the reasons for treatment and the methods involved. He must recognize the three varieties of food—carbohydrate, protein and fat—and he must have a clear knowledge of the nutritive (caloric) values of these foods. Upon his acquaintance with the composition and quantities of the foods he eats depends his ability to successfully combat his disease. Before undertaking such a study, and indeed as an introduction to it, I have inserted the following four chapters because the material which they contain applies to all types of diabetes.

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CHAPTER IV.

QUESTIONS AND ANSWERS FOR DIABETIC PATIENTS.

Knowledge Essential for a Diabetic.—The treatment of a patient with diabetes lasts through life. Treatment must therefore be adjusted to his condition, and should be so arranged that it can be continued for years without harm and with as little annoyance or interference with the daily routine as is possible. Consequently the patient must be taught the nature of his disease and how to conquer it. In the following questions and answers an attempt is made to indicate essential features of the knowledge desirable for a diabetic patient.

QUESTION 1. Why does the human body need food?

ANS. To furnish heat, repair waste, permit growth and exercise.

QUESTION 2. How may the many varieties of food be simply classified?

ANS. Carbohydrate, protein and fat, also water and salts. (Fig. 7, page 52.)

QUESTION (*a*) What is carbohydrate?

ANS. It occurs in many forms, but examples of it are sugar and starch (pages 40 and 51).

QUESTION (*b*) What is protein?

ANS. It also occurs in many forms, but examples of it are lean of meat and fish, curd of milk, white of egg. It is present to a lesser extent in grains and vegetables (pages 40 and 53).

QUESTION (*c*) What is fat?

ANS. Oil, butter, lard, the fat on meat and fish (pages 40 and 54).

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QUESTION 3. Should the diabetic patient know about foods and their relative values?

ANS. It is of the utmost importance for him to know these things, since (*a*) diabetes is a condition in which the normal utilization of carbohydrate is impaired, and (*b*) the disease is usually due to overeating (pages 18 and 19).

QUESTION 4. What is the proof that the diabetic does not make normal use of the carbohydrate eaten?

ANS. The appearance of sugar in the urine.

QUESTION 5. How much sugar is lost in the urine?

ANS. From a mere trace to two pounds in the twenty-four hours (Frontispiece; Fig. 15, page 111). The percentage of sugar in the urine may reach 10 per cent., but rarely exceeds this figure.

QUESTION 6. How is the urine tested for sugar?

ANS. In many ways. The Benedict test is one of the most reliable (page 168; also Fig. 6, page 37).

QUESTION 7. Why are diabetics unusually hungry?

ANS. Because they must eat enough to sustain life and in addition enough to make up for the sugar lost in the urine (page 22).

QUESTION 8. Why are diabetics abnormally thirsty?

ANS. Because they must produce enough urine to dissolve the sugar and thus remove it from the body.

QUESTION 9. What is the aim of treatment?

ANS. The improvement of the condition of the patient, which is best indicated by urine which is sugar-free.

QUESTION 10. What is the nature of the treatment?

ANS. Restriction of the variety and quantity of the food to such an extent as will remove the sugar from the urine; the cultivation of the simple life and moderate, regular exercise.

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QUESTION 11. Is treatment beneficial?

ANS. Yes. In the large majority of instances it cures disagreeable symptoms; it prevents dangerous and painful complications; it prolongs life and enables one to lead an almost normal existence. If treatment is not followed the diabetes grows worse.

QUESTION 12. How does the diabetic diet differ from the normal diet?

ANS. Usually by the smaller quantity of carbohydrate and the greater quantity of fat (Fig. 12, page 65).

QUESTION 13. How can sugar be removed from the urine (or, in other words, the patient become sugar-free)?

ANS. In mild cases by eating less and exercising more. In moderate cases by great care in not eating a particle of unnecessary food and by reducing the quantity of carbohydrate and protein. In severe cases by omitting the fat from the diet, by which the danger of acid poisoning is prevented, and then reducing the carbohydrate and protein, or in a few cases by fasting.

QUESTION 14. When the urine of the patient is sugar-free what is done next?

ANS. A little carbohydrate and protein are first given the patient and then fat, meanwhile testing the urine daily to determine whether the total quantity of food and the different varieties of it can be increased without the return of sugar.

QUESTION 15. What can a diabetic patient do for himself besides keeping the urine sugar-free?

ANS. Be cheerful and be thankful that his disease is not cancer, tuberculosis or Bright's disease, but a disease which his brains will help him to conquer. Keep his skin and teeth scrupulously clean. Avoid people with head colds and sore throats. Secure a daily action of the bowels. Sleep nine or more hours at night and invariably take at least half an hour off during the day. Exercise moderately in the forenoon, afternoon and evening.

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QUESTION 16. What is the commonest enemy of the diabetic?

ANS. Acid poisoning, often termed acid intoxication or acidosis.

QUESTION 17. How can acid poisoning be prevented?

ANS. Practically always by keeping sugar-free. If the patient feels "sick" and is in doubt about acid poisoning he need not worry if he (1) goes to bed; (2) drinks a glass of hot water, tea or coffee or clear, thin broth slowly every hour or hour and a half, or if nauseated takes the same quantity of liquid by enema, but in the form of salt solution (a level teaspoonful of salt to the pint of water); (3) fasts; (4) moves the bowels by injection; (5) procures a nurse or has someone to act as nurse so that he is relieved of all responsibility; and finally (6) avoids soda or other alkali.

QUESTION 18. What should a diabetic weigh?

ANS. From 10 to 20 per cent. below the average weight for his height and age. (Table 28, p. 106). Why? Because if the body is under weight it will not be necessary to eat as much to maintain weight, and thus there will be less of a burden of food for the body to assimilate.

QUESTION 19. What is a calorie?

ANS. A calorie is a measure of heat, just as a gram or an ounce is a measure of weight. It represents the quantity of heat which is necessary to raise 1 kilogram of water 1° Centigrade or 1 pound of water 4° Fahrenheit.

QUESTION 20. (*a*) How many calories are produced in the body by the utilization of 1 gram of carbohydrate, protein and fat?

1 gram carbohydrate produces 4 calories.
1 gram protein produces 4 calories.
1 gram fat produces 9 calories.

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QUESTION (*b*) How much food does a diabetic patient need?

ANS. About 25 to 30 calories per kilogram body weight or 12 to 14 calories per pound. This is a little less than for the ordinary individual.

A diabetic patient at the beginning of treatment should be made to understand that he is taking a course in diabetes. For successful graduation in the course he should be able:

1. To demonstrate how to test the urine for sugar (page 168).
2. To serve himself with approximate accuracy, without scales, 75 grams of a 5 per cent. vegetable (page 39).
3. To record a summary of his diet for the previous day (page 42).
4. To explain the quantity of carbohydrate which it contains (page 43).
5. To state his diet on his weekly fast day (page 99).
6. To describe what he is to do if sugar returns in the urine (page 97).
7. To describe what he is to do if he has reason to believe that he is threatened with acid poisoning (pages 32 and 104).

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CHAPTER V.

DIABETIC ARITHMETIC.

A Letter to a Grammar-school Girl.

Dear Freda:

Diabetic patients often get discouraged about the arithmetic of their diet, and it has occurred to me that if I could explain it to you, a little girl, the same explanation should be simple enough for grown-ups. The chief difficulty arises from the fact that when the doctors talk about the diabetic diet they speak of grams and kilograms, cubic centimeters and liters, instead of ounces and pounds, pints and quarts. The reason for this is that it is a great deal more convenient to reckon food values by the metric system. I do not know of a doctor who uses the avoirdupois system in the treatment of his patients and in his reports about them whose plan of treatment of his patients is adopted by any other doctor. First of all therefore let me explain the metric system.

The unit of weight in the metric system is the gram. This is a small weight, and if you will remember that a nickel, five cent, coin weighs exactly 5 grams you will always have a correct idea of it. Six nickels (30 grams) would weigh an ounce, and 1000 grams (200 nickels) make a kilogram, which is the weight commonly used in all European countries instead of our pound. A kilogram is 2.2 pounds. It is better to use decimals—2.2 pounds—than fractions—2⅕ pounds—for the decimal system, when you are thoroughly familiar with it, is much easier to employ. That you may better understand what a kilogram really means, divide your own weight in pounds by 2.2 and the result is your weight in kilograms. A shredded wheat biscuit weighs 30 grams (1 ounce) and so do three large portions of butter or six lumps of sugar.

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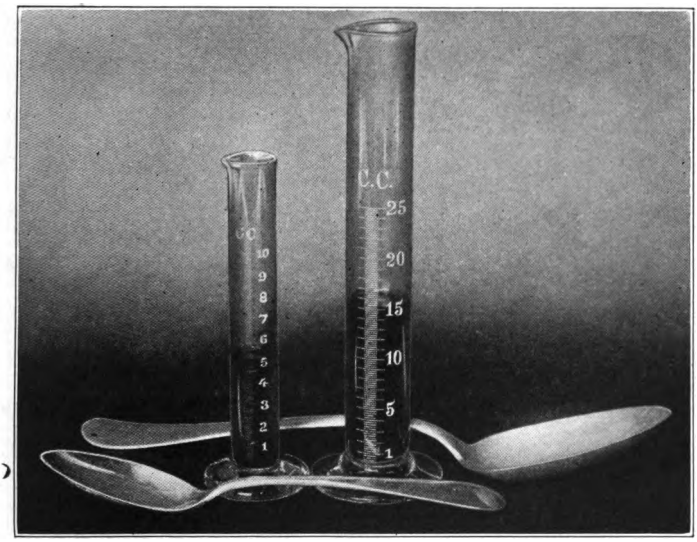
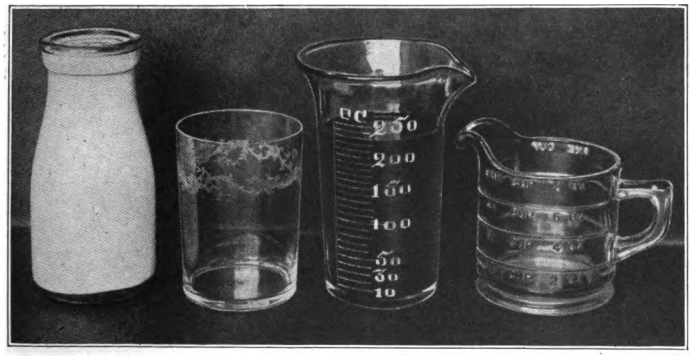


a *b*

FIG. 2.—*a*, teaspoon, capacity 5 c.c.; *b*, tablespoon, capacity 15 c.c. or ½ ounce.



a *b* *c* *d*

FIG. 3.—*a*, cream, ½ pint or 237 c.c.; *b*, drinking glass, capacity 8 ounces; *c*, 250 c.c. graduate, contains ½ pint fluid; *d*, measuring cup, capacity 8 ounces.

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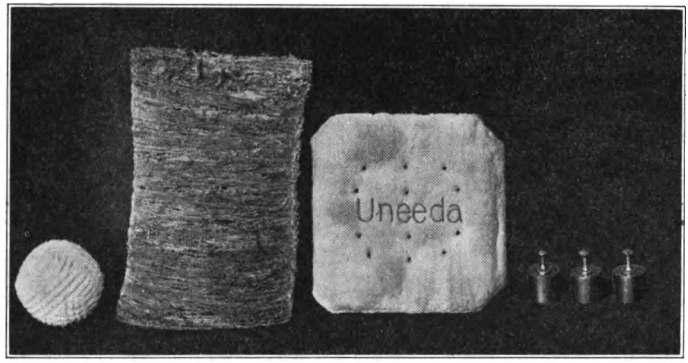
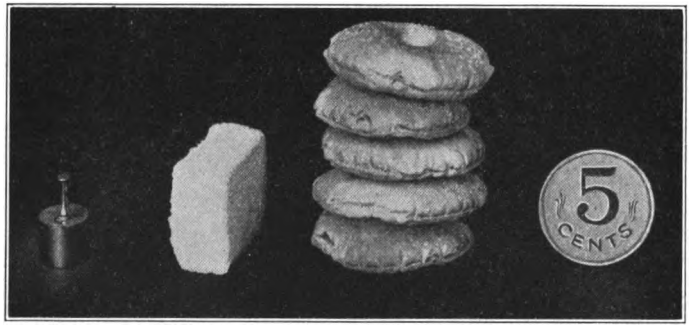
The average egg weighs 60 grams (2 ounces) and a banana (peeled) 100 grams.

30 grams = 1 ounce,[1]
1000 grams = 1 kilogram or 2.2 pounds.



a *b* *c* *d*

FIG. 4.—*a*, butter, 10 grams; *b*, shredded wheat, 30 grams; *c*, Uneeda biscuit, 6 grams; *d*, three 10-gram weights, total, 30 grams.



a *b* *c* *d*

FIG. 5.—*a*, 5-gram weight; *b*, lump sugar, weight, 5 grams; *c*, 5 oyster crackers, weight, 5 grams; *d*, Buffalo 5-cent piece, weight, 5 grams.

The liquid measures used are cubic centimeters and liters, and these are employed instead of ounces, gills, pints and

[1] Actually 28.4 grams.

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quarts. Thirty[1] cubic centimeters make a fluidounce, and you know in your cooking that it takes 2 tablespoonfuls of water for each ounce, and that ordinarily 3 teaspoonfuls

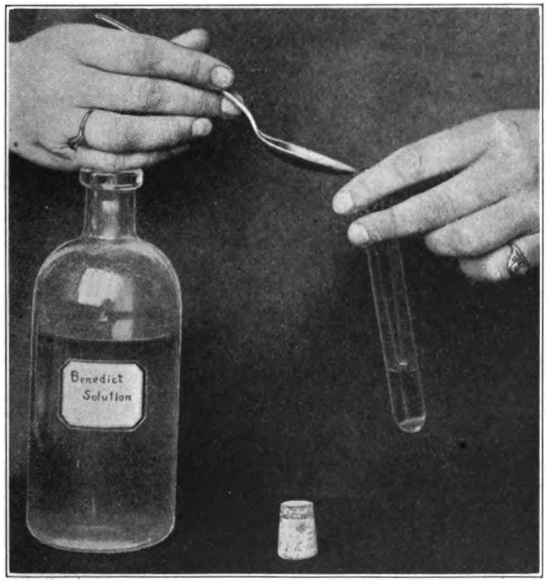

FIG. 6.—1 teaspoonful (5 c.c.) of Benedict solution in test-tube.

make a tablespoonful. One thousand cubic centimeters make one liter, and this is a little more than a quart.

30	cubic centimeters (c.c.)	=	1 (fluid) ounce.
	4 ounces	=	1 gill.
	4 gills	=	1 pint.
946	" "	2 pints	= 1 quart
1000	" "		= 1 liter.

The foods upon which diabetic patients live are nearly all printed in the lists below (Tables 5 and 6) and shown in Fig. 7 as well. Most of the foods in Table 5 come under the head of 5 per cent. vegetables. By this is meant that not

[1] Actually 29.6.

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over 5 per cent. (or 5 grams in each 100 grams) of these vegetables may be counted as carbohydrate. As a matter of fact,

TABLE 5.—FOODS ARRANGED APPROXIMATELY ACCORDING TO CONTENT OF CARBOHYDRATE.

Vegetables (fresh or canned).

5 per cent.[1]	**10 per cent.**[1]	**15 per cent.**	**20 per cent.**
Lettuce	Tomatoes	Pumpkin	Green peas	Potatoes
Cucumbers	Brussels sprouts	Turnip	Artichokes	Shell beans
Spinach	Water cress	Kohl-rabi	Parsnips	Baked beans
Asparagus	Sea kale	Squash	Canned lima beans	Green corn
Rhubarb	Okra	Beets		Boiled rice
Endive	Cauliflower	Carrots		Boiled macaroni
Marrow	Egg plant	Onions		
Sorrel	Cabbage	Mushrooms		
Sauerkraut	Radishes			
Beet greens	Leeks			
Dandelion greens	String beans			
Swiss chard	Broccoli			
Celery				
	Fruits.		
Ripe olives (20 per cent. fat)	Oranges	Apples	Plums
Grape fruit	Cranberries	Pears	Bananas
Lemons	Strawberries	Apricots	Prunes
	Blackberries	Blueberries	
	Gooseberries	Cherries	
	Peaches	Currants	
	Pineapple	Raspberries	
	Watermelon	Huckleberries	
	Nuts.		
Butternuts	Brazil nuts	Almonds	Peanuts
Pignolias	Black walnuts	Walnuts (English)	**40 per cent.**
	Hickory	Beechnuts	Chestnuts
	Pecans	Pistachios	
	Filberts	Pine nuts	
Miscellaneous.			
Unsweetened and unspiced pickle, clams, oysters, scallops, liver, fish roe.			

[1] Reckon available carbohydrates in vegetables of 5 per cent. group as 3 per cent.; of 10 per cent., group as 6 per cent.

Water, clear broths, coffee, tea, cocoa shells and cracked cocoa can be taken without allowance for food content.

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lettuce, at the beginning of the first column, contains 2.2 per cent., and string beans, toward the bottom of the second column, occasionally contain as much as 6 per cent. carbohydrate. The average percentage of carbohydrate for the entire group would be about 3 per cent., or 1 gram carbohydrate for each ounce (30 grams) of vegetables. A large saucerful of a 5 per cent. vegetable weighs about 150 grams and contains about 5 grams of carbohydrate. Another reason for reckoning these vegetables at 3 per cent. available carbohydrate is that when they are cooked considerable carbohydrate is lost in the water used in the cooking. The same thing applies to the vegetables in the 10 per cent. column, and I reckon these vegetables as containing 6 per cent. carbohydrate or 2 grams to the ounce. In the 15 per cent. and the 20 per cent. vegetables about their full value is available. Fruit, also, must be reckoned as containing the full quantity of carbohydrate assigned to it in the column in which it occurs.

TABLE 6.—DIET TABLE SHOWING TOTAL CALORIES AND QUANTITIES IN GRAMS OF CARBOHYDRATE, PROTEIN AND FAT IN 30 GRAMS (1 OUNCE) OF VARIOUS FOODS.

30 grams (1 ounce) Contain approximately.	Carbohydrates, grams.	Protein, grams.	Fat, grams.	Calories.
Oatmeal, dry weight	20.0	5.0	2	120
Cream, 40 per cent.	1.0	1.0	12	120
Cream, 20 per cent.	1.0	1.0	6	60
Milk	1.5	1.0	1	20
Brazil nuts	2.0	5.0	20	210
Oysters, six	4.0	6.0	1	50
Meat (uncooked, lean)	0.0	6.0	3	50
Meat (cooked, lean)	0.0	8.0	5	75
Cheese	0.0	8.0	11	130
Bacon	0.0	5.0	15	155
Egg (one)	0.0	6.0	6	75
Vegetables 5 per cent. group	1.0	0.5	0	6
Vegetables 10 per cent. group	2.0	0.5	0	10
Potato	6.0	1.0	0	30
Bread	18.0	3.0	0	90
Butter	0.0	0.0	25	225
Oil	0.0	0.0	30	270
Fish, cod, haddock (cooked)	0.0	6.0	0	25
Broth	0.0	0.7	0	3
Small orange or half of grape fruit	10.0	0.0	0	40

You will be glad that patients seldom need to know the food values of more than the 20 foods mentioned in Table 6.

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I advise patients to buy gram scales, but as many households already have ounce scales, I have arranged Table 6 so that the quantity of carbohydrate, protein and fat in an ounce, or 30 grams, of food are placed opposite that food. There are a few exceptions. You will see that the values for six oysters, one egg, a small orange or half a small grape fruit are given instead of 30 grams. For another reason I have given, in the first line, the food value of oatmeal weighed *dry*, because when oatmeal is cooked the quantity of water which it takes up is so variable that the weight of cooked oatmeal would neither be uniform from day to day nor the same with different kinds of oatmeal, whereas the food values for the *dry* weights of *all* kinds of oatmeal remain approximately the same. (See Fig. 7, p. 52.)

THE THREE FOODSTUFFS.

The value of a food depends upon the quantity of the three food materials—carbohydrate, protein and fat—which it contains.

Carbohydrate Foods.—By carbohydrate one means sugar and starch. With sugar you are acquainted, and a pure starch is cornstarch. Fruits are almost wholly water and sugar and vegetables largely water and starch. Bananas, when green, contain nearly 20 per cent. starch, but when ripened this changes to sugar. Potatoes are 20 per cent. starch. Bread is about 60 per cent. starch, and the flour out of which it is made, being drier than bread, contains about 70 per cent. Two-thirds of oatmeal is starch.

Protein Foods.—Protein is the food from which our muscles and tissues are made. Examples of protein are the lean of meat and fish, the curd of milk and the white of egg. The yolk contains just as much protein as the white, but it is mixed with fat. Protein is also found in grains, and there is considerable in beans and peas, but very little in other vegetables and almost none in fruits.

Fat Foods.—Fat is found mostly in the form of butter, oil, lard, cream and the fat on meat and fish. Rich cream contains 40 per cent. fat, and milk may contain only about 3 per cent.

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FOOD AND FUEL.

Foods are fuel for the body, just as gasoline is fuel (food) for an automobile. Man and automobile depend upon fuel as a source of energy. In case the gasoline gives out the automobile will stop, but if the food gives out the man will not immediately die, because he carries a good deal of the fuel stored up in his body, first and chiefly as fat, second, a lesser amount in the form of protein in the muscles and various tissues, and third, a little in the form of carbohydrate as animal starch (glycogen) and sugar in the liver, muscles and blood. Living upon this reserve supply of food you will remember that Prof. Benedict's man at the Carnegie Laboratory in Boston fasted for thirty-one days.

Just as one can measure how much gasoline is required for an automobile to run 100 miles, so one can measure how much food is necessary for a man to live for twenty-four hours and do a given amount of work. Small automobiles require less gasoline than large automobiles, and this is pretty much true of individuals, for the food which they need depends upon their weight. There are exceptions. Children require proportionately more food because they are growing, and old people require less because they are quieter. We cannot measure the quantity of food which we use in as simple a way as we can measure the fuel gasoline which the automobile requires because we depend upon three kinds of food. However, you can easily see that if we know the food value for 1 gram each of the foods, carbohydrate, protein and fat, and if we know how much of each food is eaten, we can then determine the total food value of the diet for the patient.

THE FOOD MEASURE.

A food measure or unit of food value has been determined for each of the three foodstuffs, and it is known as the *calorie*. By a calorie is meant the quantity of heat which is necessary to raise 1 kilogram of water 1° Centigrade, or in the English system 1 pound of water 4° Fahrenheit. Experiments have shown that 1 gram of carbohydrate or of protein will produce,

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when used up, that is, when burned in the body, 4 calories, and 1 gram of fat, 9 calories. A gram of alcohol produces 7 calories. If you read over again what I have just written and also Table 6 it is not very difficult to reckon the values of the food in a patient's diet, and I will give you an example of this in the following table:

TABLE 7.—THE COMPUTATION OF THE DIET.

Food.	Breakfast. Grams.		Dinner. Grams.		Supper. Grams.		Total grams.	Carbohydrate Grams.	Protein. Grams.	Fat. Grams.
Five per cent. veg.	100	+	200	+	150	=	450	15	8	0
Eggs (2)	2		...		...	=	2	...	12	12
Meat, cooked	...		60		...	=	60	...	16	10
Fish	...		...		60	=	60	...	12	...
Bacon	15	+			15	=	30	...	5	15
Butter	10	+	10	+	10	=	30	...	...	25
Cream, 20 per cent.	30	+	30	+	30	=	90	3	3	18
Oatmeal	15		...		...	=	15	10	3	1
					Totals	=		28	59	81
					Calories per gram	=		4	4	9
					Total calories	=		112	+ 236	+ 729 = 1077

In the first column is recorded a list of the different foods taken during the day. Of 5 per cent. vegetables you will see that 100 grams were given for breakfast, 200 for dinner and 150 for supper, making a total for the day of 450 grams. Two eggs were given at breakfast; meat was given at dinner and fish at supper, but a little bacon appears on the list for both breakfast and supper. Cream containing 20 per cent. fat was given at each meal; oatmeal only at breakfast. Knowing the total quantity of each kind of food given during the day, by using the table of food values (Table 6) one can determine the amount of carbohydrate, protein and fat for each given food. Thus, 450 grams of 5 per cent. vegetables were used. Table 6 shows that for each 30 grams (1 ounce) of 5 per cent. vegetables, there is 1 gram[1] carbohydrate and 0.5 gram protein, and therefore in 450 grams (15 ounces) there would be 15 grams carbohydrate and half as many grams protein, or 8 (actually 7.5).

Two eggs were given at breakfast. Table 6 shows that the eggs contain no carbohydrate, but that each egg contains

[1] Arithmetically, 1.5 grams, but on account of variation in vegetables and in cooking, as well as for convenience, reckoned as 1 gram.

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6 grams protein and 6 grams fat—in other words, 2 eggs contain 12 grams protein and 12 grams fat. In the same way you can reckon the amount of carbohydrate, protein and fat in 60 grams of meat (cooked), 60 grams of fish, 30 grams of bacon, 30 grams of butter, 90 grams of 20 per cent. cream (*i. e.*, cream containing 20 per cent. butter fat), and 15 grams of oatmeal. In Table 6 the quantity of carbohydrate in 30 grams of oatmeal is given as 20 grams—consequently, in 15 grams of oatmeal there would be half as much, or 10 grams carbohydrate and 3 (actually 2.5) grams of protein and 1 gram of fat.

The actual percentages of carbohydrate, protein and fat in various other foods are given in the large tables on pages 144 to 164. From these it is easy to calculate the quantity of carbohydrate, protein and fat in any food which a patient eats when the total quantity of eaten food is known. Patients and nurses somehow are repeatedly confused by such tables, forgetting that if the quantity of carbohydrate in milk is 5 per cent., that 100 grams of milk (or in this case cubic centimeters) would contain 5 grams of carbohydrate, just as 5 per cent. interest on $100 for a year would be $5. Lobster, for instance, contains 16 per cent. protein, and therefore 100 grams of lobster contain (100×0.16) 16 grams protein.

One should be familiar with percentages, because in this way one can often find the values of various foods which are not contained in the 30-gram (1-ounce) table. Should a patient, for example, wish to substitute his 8 grams of protein in the form of 30 grams of meat for 8 grams protein in the form of lobster, this could be done by his taking $(\frac{8}{0.16})$ 50 grams of lobster.

The use of percentages, however, is employed far more in determining the quantity of sugar voided in the urine by diabetic patients in the twenty-four hours. If an individual voids 2000 c.c. (cubic centimeters) of urine and the percentage of sugar is 5 per cent., it is plain that the quantity of sugar lost in the urine during the twenty-four hours would be $2000 \times 0.05 = 100$ grams. As a lump of sugar amounts to about 5 grams, this would mean that the equivalent of 20 lumps of sugar were lost in the urine in one day.

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It is interesting to compare the decrease of sugar in the urine with the reduction of carbohydrate in the diet.

In Table 8 it is to be seen how this took place. It is true that each day required quite a little arithmetic on the part of doctor and nurse, but now you could construct such a table by yourself, and I am sure would do it far better than most patients twice your age.

TABLE 8.—ILLUSTRATION OF AMBULATORY TREATMENT WITHOUT FASTING OR OMISSION OF PROTEIN. CASE NO. 1237. AGE AT ONSET IN SEPTEMBER, 1915, THIRTY-NINE YEARS AND FIVE MONTHS.

Date, 1917.	Urine.				Diet in grams.				Weight, pounds, dressed.	Dietary prescriptions in grams.							
	Volume, c.c.	Diacetic acid.	Sugar.		Carbohydrate.	Protein.	Fat.	Calories.		Vegetables, 5 per cent.	Fish.	No. of Oranges.	Meat.	No. of Eggs.	Bacon.	Butter.	Cream, 20 per cent.
			Per cent.	Total gms.													
Feb. 17	4000	0	8.4	336													
19	1500	0	2.2	33	54	84	0	....	...	720	360	3					
20	1500	0	1.8	27	54	84	0	....	...	720	360	3					
21	1250	0	1.8	23	39	84	0	....	142	720	360	1½					
22	1500	0	0.4	6	24	84	0	432	...	720	360	0					
23	1250	0	0.2	3	24	84	0	432	...	720	360	0					
24	1500	0	Tr.	0	24	84	0	432	...	720	360	0					
25	1500	0	Tr.	0	24	84	15	567	139	720	240	0	90				
26	....	0	0	0	24	84	39	783	...	720	120	0	90	4			
27	1250	0	0	0	24	82	57	937	...	720	120	0	90	2	60		
Mar. 1	....	0	0	0	24	82	82	1162	...	720	120	0	90	2	60	30	
3	....	0	0	0	26	84	94	1286	138	720	120	0	90	2	60	30	60
6	....	0	0	0	32	85	106	1422	...	720	120	½	90	2	60	30	90
9	....	0	0	0	42	85	106	1462	136	720	120	1½	90	2	60	30	90
13	....	0	0	0	54	87	168	2076									

With many thanks for your cheerful help in the care of my patients at the hospital, and for your faithfulness to treatment at all times, I remain,

Your friend,

ELLIOTT P. JOSLIN.

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CHAPTER VI.

EFFICIENCY IN VISITS TO A DOCTOR.

DIABETIC patients frequently fail to get the benefit they should derive from a visit to their physician because they do not furnish the facts upon which advice for further treatment can be based. The physical appearance of the patient is by no means a satisfactory guide. Information must be furnished concerning the examination of the urine and concerning the diet. The efficient coöperation of the patient is necessary.

1. **Information Obtained by Examination of the Urine.**—The physician should know whether the urine of the patient is free from sugar, or, if present, how much it contains. This is essential in order to prescribe the diet for the following days. The patient should therefore take with him a specimen of the urine saved from the entire twenty-four-hour amount. To collect such a specimen of urine, discard that voided at 7 A.M., and then save all urine passed up to and including that obtained at 7 the next morning. Take one-half pint of the thoroughly mixed twenty-four-hour quantity for examination. Record the twenty-four-hour amount of urine and the name on the bottle. The bottle in which the urine is being collected should be kept in a cool place. It is best to procure a bottle[1] for this special purpose sufficiently large to hold the entire twenty-four-hour amount of urine. Select a bottle with a large mouth, that it may be more easily cleansed. The bottle should be scalded out daily. It should have a tight-fitting cork. Urine so collected decomposes slowly. On account of the presence of sugar, diabetic urines are prone to ferment, and if fermentation occurs a portion of the sugar disappears and invalidates any subsequent test for the quantity of sugar which the urine contained when voided.

2. **Information Obtained by Examination of the Diet.**—The quality and quantity of the food eaten during the twenty-four hours of the collection of the urine should be recorded. If thirty minutes are allowed for a visit to the physician's office

[1] Bottles, known to the druggists as percolator bottles, and graduated in 100 c.c. up to 2000 c.c. are most convenient.

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it is no exaggeration to say that unless this recording of the diet is neatly done, one-third to one-half of the visit is spent by the physician in learning what the patient has eaten. For this reason my intelligent patients always bring a diet list arranged according to the plan shown in Table 7 (page 42).

Even if the quantity of carbohydrate, protein, fat and calories are not worked out by the patient, the grouping together of 5 per cent. vegetables, the summary of the total quantity of butter, cream, meat, eggs, fish, oatmeal and fruit, rather than the hit-or-miss record of the amount taken at each meal, saves really an enormous amount of time, and time which can be used by the physician in helpful advice. In other words, the patient should go to the physician for treatment rather than for a lesson in grammar-school arithmetic.

3. **Body Weight.**—If the patient has scales, the weight fasting and preferably undressed on the morning of the visit should be taken.

4. **Note Book.**—The patient should have a note book, and all questions about symptoms and diet which have arisen since the former visit should be neatly set down, with space left for an answer to each question. It is a common error for patients to ask the same question many times, whereas if the answer is written down by the physician the question would thus be answered once for all time. Furthermore, it is a great advantage for a patient to keep a note book, because gradually it becomes valuable for reference, and his whole plan of treatment is systematized.

The note book should contain a statement as to whether sugar has been present or absent in the urine since the last report to the physician. Such data can easily be gathered on one page and again thus save time. When a patient comes to my office with a single specimen of urine instead of a portion taken from the twenty-four-hour quantity, and without any record of the food eaten during the preceding day, and starts in to recount that he had nothing but eggs, meat and fish, then later remembers that he had a little cream and various vegetables, then with prompting recalls butter and an orange and a little oatmeal, I always pity him, and on very exceptional occasions am able to recall with satisfaction after the interview Solomon's soliloquy in Proverbs xvi, verse 32.

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CHAPTER VII.

HYGIENE FOR THE DIABETIC.

ANY agency which promotes physical or mental hygiene is a step toward the prevention of diabetes in the predisposed and the abatement of its severity when it has appeared. It is only justice to Hodgson to say that for years in dealing with his patients he has urged that they "should be kept mentally indolent and physically active." The experiments of Cannon, Folin and their associates upon the appearance of sugar in the urine of animals and of both normal and insane individuals following periods of great emotional excitement have demonstrated the truth of the former half of the motto. Therefore all individuals who have a tendency toward diabetes should be especially urged to take vacations, and the good effect of vacations should be generally pointed out. I have never forgotten the remark of Dr. Sabine, of Brookline, that in the course of his long practice he had observed that those of his patients who had taken active camping trips in the woods bore the stress of modern life best. By this means exercise was combined with mental relaxation. That the good effects of each last for months is not hard to believe. It is only natural to conclude that if the muscles, in which is stored one-half of the carbohydrate of the body, are kept in good condition by training, a favorable effect must be exercised upon the general metabolism of carbohydrate. Pedometers are to be encouraged. It is better to discuss how far you have walked than how little you have eaten. Stimulated by Dr. Allen I have gradually increased the exercise of all my patients, except those unduly weak or in a dangerous condition upon entrance to the hospital. The effect of this increase of exercise upon the well-being of fat diabetics has been pronounced, and it is striking how many miles a semi-

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ill or obese diabetic patient can learn to walk during two weeks. The patients are encouraged to take their walks soon after meals and to go outdoors at least five times in the day. Not alone are the good effects of exercise shown by freedom of the urine from sugar with an increased carbohydrate tolerance, but by improved circulation and general well-being. Even fasting diabetics, as a rule, appear to do better when up and about the wards for a few hours a day than when abed. However, caution is necessary in suggesting this plan to severe cases of diabetes. No case should be considered too far advanced for an attempt at muscular redevelopment. I have seen two patients so weak from lowered vitality that they could not stand, through the help of skilful massage and carefully planned dietetic treatment again begin to walk.

If the patient, by means of exercise, can have 5 grams more of carbohydrate a day the added comfort will be enormous, for the addition of 5 grams of carbohydrate to a diet in a case of severe diabetes brings almost untold joy. It allows various alternatives, such as half a small orange, 50 grams of strawberries, a small tablespoonful of cooked oatmeal or a potato half the size of a pullet's egg.

Case No. 1024, a lady, aged seventy-eight years, I learned from Miss Walker, her nurse, not only takes exercise in the forenoon and afternoon, but goes out for her walk in the evening with a flash light.

Case No. 804, a patient whose diabetes has changed from severe to moderate, and finally from moderate to mild under his own care at home, writes me that he considers exercise of the greatest importance. He says that he has the best garden of anyone in his city.

Case No. 352, a diabetic who has outlived his expectation of life, is now seventy years of age, having had diabetes twenty-three years, and throughout this time has led a most active life. He writes:

"First, it is very hard to start the exercise, and the less one feels inclined to start the more one needs it. Second, it is neither necessary nor desirable that it should be violent. I found a quiet ride of an hour, walking or jogging after taking

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something on the stomach, started up my old metabolism for the whole day. If I rode hard I got tired out."

Finally, it is astonishing how much exercise a diabetic in training can take. One of my severe cases, living on a strict diet, several years ago walked between twenty and thirty miles in one day. Inquiry elicited the following letter from Case No. 783, a Harvard student, who frequently shows a small trace of sugar, a case which borders upon the renal type of diabetes. The blood sugar one morning before breakfast was 0.07 per cent.:

CAMBRIDGE, MASS., Dec. 1, 1915.

"MY DEAR DOCTOR JOSLIN:

"I first noticed the effect of exercise last spring. I was rowing for exercise at the time, and observed that if I went out on the river about a half-hour after lunch and rowed for an hour or less the test would not show any sugar in the urine at any time during the afternoon, even though I ate potatoes and a small amount of bread for lunch. But if I ate potatoes (no bread) without so exercising the test always showed sugar about two hours after the meal."

Rest is essential. A tired child is put to bed and wakens refreshed; one of the most noted surgeons in our country is not ashamed to leave his guests at the table and lie down for fifteen minutes after his luncheon; the best treatment for a failing heart is to put its owner in bed for a week. Diabetic patients should rest often, should never get tired and should avoid athletic contests. The diet is designed to give a rest to the pancreas. Sleep nine hours and more if you can, and get another hour of rest by day. Short periods of complete relaxation yield maximal returns.

Forget you have diabetes and do not talk about it with others. This is one reason for not using saccharin, and another is to avoid the perpetuation of a sweet taste, thus reviving the thought of the previously unrestricted diet.

Mental diversion is desirable, but anxiety is harmful. Heavy responsibilities should be avoided as well as nervous upsets and emotional excitements. It is almost as dangerous for a diabetic to get angry as for a man with angina pectoris.

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Case No. 1157 had been sugar-free for five days, but it came back when he had an important conference with one of his superintendents.

Wear warm clothes instead of staying by the radiator or in an overheated room.

The change in the mental attitude of patients during the course of treatment is a gratifying encouragement to the physician. Untreated diabetics after a moderate number of years usually show depression, and with women this often becomes pronounced. In the first ten years of my experience with diabetes I was much impressed with the tendency of such patients to cry, but even then, with the methods in vogue, it was interesting to see how depression disappeared with the decrease or disappearance of sugar in the urine. This could not be explained by the mental encouragement which a patient derived from his knowledge of the decrease in sugar excretion. Even when patients became sugar-free but developed acidosis, mental symptoms often improved, and to so great an extent that one could say that with treatment, even though it did end in coma, the patient enjoyed life far more thoroughly than when untreated. During the last two years and a half the mental attitude of the patients has improved still more. The enthusiasm about new methods of treatment has been so great as to account partially for this, but the actual improvement in health which the patients have felt has been of more importance. Greeley explained to my patients how diabetes has largely been robbed of its terrors. He urged the simple life as a great aid in treatment and told them not to try to be first in the Iberian village and be ill, but rather to be second in Rome and keep well. He told them to have a hobby, and not to make it a labor; to be cheerful and to keep their minds occupied, and, so far as possible, to continue the previous currents of their lives.

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PART II.

THE DETAILS OF DIABETIC TREATMENT.

CHAPTER I.

THE DIET OF NORMAL INDIVIDUALS.

THE diet of the normal individual is made up chiefly of carbohydrate, and to a lesser extent of protein and fat.

Carbohydrate in the Normal Diet.—The carbohydrate foods are divided into starches and sugars. Everyone is familiar with the conversion of starch into sugar, as in the ripening of a banana. In the body this is the common event, and is brought about through the activity of the digestive glands. Carbohydrate is found chiefly in the vegetable kingdom, as in cereals, sugar-cane, vegetables and fruits. Milk contains 5 per cent. of sugar. Meat, fish and eggs are entirely free from carbohydrate save for an extremely small percentage of animal starch (glycogen) to be found in liver. By a carbohydrate-free diet, therefore, one usually means a diet consisting of meat, fish, eggs and pure fat (such as butter and oil), broths, coffee and tea.

The quantity of carbohydrate in various foods is shown in Fig. 7 graphically, p. 52 and in Table 9. Under the heading 5 per cent. are placed foods which contain not over 5 per cent. carbohydrate; in the 10 per cent. group those which contain 5 to 10 per cent. carbohydrate; in the 15 per cent. and 20 per cent. groups those with about 15 and 20 per cent. carbohydrate respectively. The foods in each group are also arranged according to the amount of carbohydrate which

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they contain. Thus, lettuce, at the beginning of the list, contains about 2 per cent. carbohydrate, and string beans toward the end of the second column, about 6 per cent. For

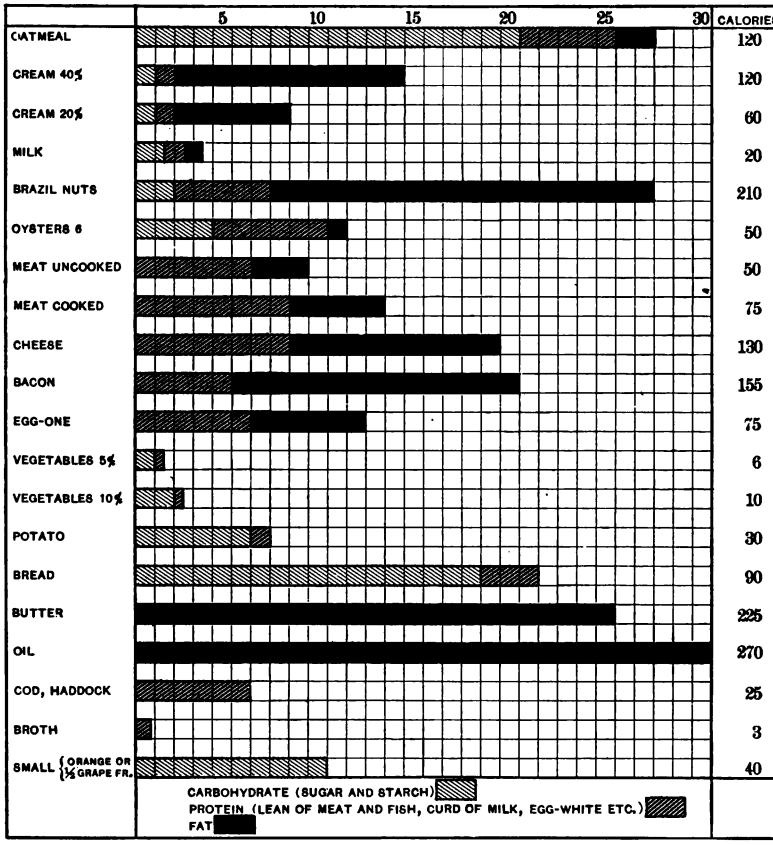

FIG. 7.—Diet table showing total calories and quantities in grams of carbohydrate, protein and fat in 30 grams (1 ounce) of various foods. Each lineal division represents 1 gram.

this reason, and also because a portion of carbohydrate is often lost in the cooking or is present in the form of cellulose which is unassimilable, one may reckon the average per-

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centage of carbohydrate in a mixture of 5 per cent. vegetables as 3 per cent., and similarly a mixture of 10 per cent. vegetables as 6 per cent. The carbohydrate in the 15 and 20 per cent. groups should be taken at its full value.

TABLE 9.—FOODS ARRANGED APPROXIMATELY ACCORDING TO CONTENT OF CARBOHYDRATES.

Vegetables (fresh or canned).

5 per cent.	**10 per cent.**	**15 per cent.**	**20 per cent.**
Lettuce	Pumpkin	Green peas	Potatoes
Cucumbers	Turnip	Artichokes	Shell beans
Spinach	Kohl-rabi	Parsnips	Baked beans
Asparagus	Squash	Canned lima beans	Green corn
Rhubarb	Beets		Boiled rice
Endive	Carrots		Boiled macaroni
Marrow	Onions		
Sorrel	Mushrooms		
Sauerkraut			
Beet greens			
Dandelion greens			
Swiss chard			
Celery			
Tomatoes			
Brussels sprouts			
Water cress			
Sea kale			
Okra			
Cauliflower			
Egg plant			
Cabbage			
Radishes			
Leeks			
String beans			
Broccoli			

	Fruits.		
Ripe olives (20 per cent. fat)	Oranges	Apples	Plums
Grape fruit	Cranberries	Pears	Bananas
Lemons	Strawberries	Apricots	Prunes
	Blackberries	Blueberries	
	Gooseberries	Cherries	
	Peaches	Currants	
	Pineapples	Raspberries	
	Watermelon	Huckleberries	

	Nuts.		
Butternuts	Brazil nuts	Almonds	Peanuts
Pignolias	Black walnuts	Walnuts (English)	**40 per cent.**
	Hickory	Beechnuts	Chestnuts
	Pecans	Pistachios	
	Filberts	Pine nuts	

Miscellaneous.
Unsweetened and unspiced pickle, clams, oysters, scallops, liver, fish roe.

Protein in the Normal Diet.—Protein is an essential constituent of the diet, for out of protein the cells and tissues of

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the body are formed. Examples of protein are the white of egg, lean of meat or fish and curd of milk. White of egg is pure protein and water. In the white of one egg are 3 grams protein, and the yolk contains an equivalent quantity, combined, however, with 6 grams of fat.

TABLE 10.—THE QUANTITY OF CARBOHYDRATE, PROTEIN AND FAT AND THE CALORIC VALUE OF THIRTY GRAMS (ONE OUNCE) OF FOODS IN COMMON USE.

30 grams (1 ounce) Contain approximately.	Carbohydrates, grams.	Protein, grams.	Fat, grams.	Calories.
Oatmeal, dry weight	20.0	5.0	2	120
Cream, 40 per cent.	1.0	1.0	12	120
Cream, 20 per cent.	1.0	1.0	6	60
Milk	1.5	1.0	1	20
Brazil nuts	2.0	5.0	20	210
Oysters, six	4.0	6.0	1	50
Meat (uncooked, lean)	0.0	6.0	3	50
Meat (cooked, lean)	0.0	8.0	5	75
Bacon	0.0	5.0	15	155
Cheese	0.0	8.0	11	130
Egg (one)	0.0	6.0	6	75
Vegetables 5 per cent. group	1.0	0.5	0	6
Vegetables 10 per cent. group	2.0	0.5	0	10
Potato	6.0	1.0	0	30
Bread	18.0	3.0	0	90
Butter	0.0	0.0	25	225
Oil	0.0	0.0	30	270
Fish, cod, haddock (cooked)	0.0	6.0	0	25
Broth	0.0	0.7	0	3
Small orange or half of grape fruit	10.0	0.0	0	40

Table 10 contains a list of foods which I have found most commonly eaten by diabetic patients and, indeed, by normal individuals. *Anyone who masters this table will know the essentials of the diabetic diet.* It is well worth while to study carefully both Fig. 7 and Table 10 here numerically compiled.

Fat in the Normal Diet.—Fat and carbohydrate are to a large extent interchangeable. In northern climates fat forms a large part of the diet while in the tropics it is replaced by an excess of carbohydrate. Examples of fat in its pure form are oil and lard. Butter and the substitutes for it contain 85 per cent. or more fat. Common cheese is one-third fat. The fat in meat varies from that in fat bacon, in which the percentage occasionally rises to 80, to chicken,

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in which the percentage of fat is 3 or less. In codfish and haddock the amount of fat is negligible, but in salmon it reaches 13 per cent. Nuts are rich in fat.

Food Values and Food Requirements.—The quantity of food which an individual requires has been estimated in various ways. One method has been to weigh the amount of food eaten by a large number of individuals and then calculate the amount consumed by each individual. I imagine that it is upon this basis to a considerable extent that soldiers are assigned their rations. The rations now furnished the soldiers in various armies are reported to be as follows:

TABLE 11.—SOLDIERS' RATIONS.

	Carbohydrate, grams.	Protein, grams.	Fat, grams.	Calories.
United States garrison ration . .	651	185	141	4751
Russian ration in Manchurian war	487	215	90	3717
British ration	524	224	195	4962
Italian ration[1]	560	145	93	3745
French ration (normal)	402	130	117	3478

The rations allowed for prisoners in the German prisoner-of-war camps in the period prior to the stringency in foodstuffs and in a later period of stringency are given below.[2] In general, one can be quite sure that the prisoners were not allowed more than the civil population.

TABLE 12.—RATIONS ALLOWED IN GERMAN PRISONER-OF-WAR CAMPS.

	Carbohydrate, grams.	Protein, grams.	Fat, grams.	Calories.
Daily diet prior to stringency . .	510	89	30	2740
Daily diet during stringency . .	310	57	21	1720

Another method allows the food required by a given individual to be calculated far more accurately. By this method the heat given off by a man at rest or at work has been determined. The quantity of food is then estimated which is required in the course of its oxidation in the body to produce an equivalent amount of heat. The heat liberated in the oxidation of the various foodstuffs has been determined and

[1] From unofficial sources.

[2] Taylor, A. E.: Jour. Am. Med. Assn., 1917, lxix, p. 1575.

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is measured in heat units known as calories. A calorie represents the heat which is necessary to raise 1 kilogram of water 1° Centigrade, or 4 pounds of water 1° Fahrenheit. For each kilogram (2.2 pounds) body weight per twenty-four hours it has been found that an individual requires at rest 25 calories and at light work 30 calories. Experiments have demonstrated that the heat which is liberated in the body from the combustion of 1 gram of protein or of carbohydrate produces 4 calories, from 1 gram of fat 9 calories, and from 1 gram of alcohol 7 calories. Fat is, as we would expect, more than twice as nourishing as carbohydrate or protein. With these figures in mind, it is easy to estimate with sufficient exactness from dietetic tables the calories in the diet, and to compare the result with the number of calories required. For scientific accuracy frequent analyses must be made of samples of the food eaten.

It will be noted in the above paragraph that the metric system of weights and measures is given preference. This is done because it is far easier in diabetic work to deal with grams and cubic centimeters than with ounces, pounds and quarts. The only figures in the metric system necessary to remember are those shown in Table 13.

TABLE 13.—WEIGHTS AND MEASURES EMPLOYED IN THE ESTIMATION OF THE DIET.

30 grams	= 1 ounce.[1]
30 cubic centimeters	= 1 fluidounce.[2]
1000 grams	= 1 kilogram — kilo or kg. (2.2 pounds).
1000 cubic centimeters	= 1 liter.
16 ounces	= 1 pound (454 grams).
32 ounces	= 1 quart (946 c.c.).
1 gram carbohydrate	= 4 calories.
1 gram protein	= 4 calories.
1 gram fat	= 9 calories.

In estimating carbohydrate, protein and fat in the diet or sugar in the urine, enough accuracy is obtained in clinical work by considering that 30 grams (g.) or 30 cubic centimeters (c.c.) equal an ounce, dry or fluid measure.

[1] Actually 28.4 g. [2] Actually 29.6 c.c.

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Individuals with sedentary occupations require approximately 30 calories per kilogram body weight. Thus a man weighing 70 kilograms (70 kilograms × 2.2 pounds = 154 pounds) would need (70 × 30) 2100 calories. The caloric needs of the body, however, vary not only from day to day but from moment to moment. Thus an individual lying down requires not far from 25 calories per kilogram body weight, but at moderate work 30 or more. So much of the twenty-four hours is spent sleeping that the individual saves then what he uses at other periods. To walk one hour on a level road at the rate of 2.7 miles an hour requires 160 calories above that of keeping quiet, according to Lusk. For a man to ascend a flight of stairs ten feet high about 3 calories are necessary. Table 14 shows the calories needed according to the amount of work done.

TABLE 14.—CALORIES REQUIRED DURING TWENTY-FOUR HOURS BY AN ADULT WEIGHING SEVENTY KILOGRAMS (ONE HUNDRED AND FIFTY-FOUR POUNDS).

Condition.	Calories per kilogram, body weight.	Calories per pound, body weight.	Total calories.
At rest	25 to 30	11 to 14	1750 to 2100
At light work . .	35 to 40	16 to 18	2450 to 2800
At moderate work .	40 to 45	18 to 20	2800 to 3150
At hard work . .	45 to 60	20 to 27	3150 to 4200

Children require far more food than adults because of growth and increased activity. This is shown in Table 15.

TABLE 15.—CALORIC NEEDS OF CHILDREN DURING TWENTY-FOUR HOURS.

Age in years.	Weight: kg.	Weight: pounds.	Calories per kilogram, body weight.	Calories per pound, body weight.	Total calories.
2	12	26	80	36	960
6	20	44	70	31	1400
12	36	80	50	23	1800

Composition of the Normal Diet.—The ordinary diet for a man at moderate physical work would contain about 400 grams of carbohydrate, 100 grams of protein and 100 grams of fat. This would amount to 2900 calories in the twenty-four hours, or about 40 calories per kilo for an individual

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weighing 70 kilograms. These figures would be proportionately reduced both for those of lower body weight and for those with lighter occupations who would require nearer 30 calories per kilo. As age advances the metabolic requirements are lessened; thus if 2000 calories are required at thirty years, 1800 calories will suffice at seventy and 1600 at eighty years of age.

TABLE 16.—THE PROPORTION OF CARBOHYDRATE, PROTEIN AND FAT IN THE NORMAL DIET.

Food.	Quantity, grams.	Calories, per gram.	Total calories.
Carbohydrate	400	4	1600
Protein	100	4	400
Fat	100	9	900
			2900

Chittenden, in his painstaking and scientific manner, accomplished an immense amount of good when he showed that people ordinarily consumed much more food than physiological needs demand. He suggests that it is more than probable that this excess of food is in the long run detrimental to health, weakening rather than strengthening the body and defeating the very object of nutrition.

From the preceding statements it will be seen that 55 per cent. of the energy of the diet of the normal individual consists of carbohydrate. These figures are only approximate, but they leave no doubt as to how large a place sugar and starch occupy in the daily ration. Fig. 8 shows graphically the relative caloric value of the different foodstuffs in the total diet.

The quantity of protein in the normal diet is probably decidedly less than 100 grams. From Cannon's investigations at the Harvard Medical School it would appear that these active, hard-working students, with their regular activities, ate about 90 grams each day. There is comparatively little doubt but that it is safe for an individual to get along on 1 gram protein for each kilogram body weight, and I have no worries if my patients secure 60 grams protein,

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though the students ate rather more. Protein is animal food to a large degree; hence its cost. This is an added reason for being sparing in the use of protein. There is also still another reason, for when an excess of protein is burned the other foods are also consumed more rapidly, and there is more chance for the heat produced to go to waste.

The quantity of fat in the normal diet varies, partly from choice and partly from economic reasons. In general, in those cases in which the carbohydrate in the diet is high, the fat is low, and *vice versa*. The Voit standard placed the fat at 55 grams, but in a series of 1300 dietary studies of families, carried out among different races and in different countries, it was shown that the average quantity of fat eaten was about 135 grams (4.5 ounces) per person per day, the variation recorded being from 45 to 390 grams per person per day.

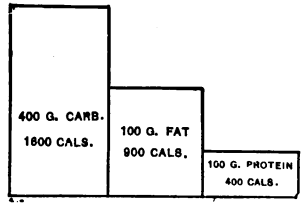

FIG. 8.—The relative caloric value of protein, carbohydrate and fat in a normal diet.

The more agreeable varieties of fat, such as butter, cream and oil, are expensive foods. Fat is also a concentrated food, not only because it has twice the caloric value of either carbohydrate or protein, but because it occurs more frequently in pure form. Oil, butter and lard contain little water, whereas except for pure sugar and starch most carbohydrates and proteins are diluted five to ten times with water.

The chief source of error in calculating the total caloric value of the diet, and especially of the diabetic diet, is in the estimation of fat. Anyone can realize this upon examining a piece of meat with its fringe of fat. The fat in bacon is

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most variable, and in amount its value can only be approximately estimated. Portions of bacon lose varying quantities of weight in the cooking, as shown in Table 17. (See the column for percentage loss.)

TABLE 17.—LOSS OF WEIGHT OF BACON DURING COOKING.

Uncooked, grams.	Cooked, grams.	Lost, per cent.
80	46	43
200	100	50
50	17	66
60	23	62
30	10	67

Eggs in some cities by law must weigh a pound and a half a dozen, an average of 60 grams (2 ounces) apiece. Such eggs contain approximately 6 grams of protein and 6 grams of fat. How gross our caloric reckonings are is obvious if a collection of eggs is weighed and the minimum and maximum weights noted. The weight of the heaviest egg in such a collection was 72 per cent. more than that of the lightest. (See Table 18.)

TABLE 18.—VARIATIONS IN WEIGHTS OF EGGS WITH THE SHELLS.

Number of eggs weighed.	Minimum, grams.	Maximum, grams.	Variation, per cent.
9	52	63	21
12	40	62	55
11	56	63	12
12	51	69	35
12	48	66	38

The weight of one egg shell is usually about 7 grams.

Milk may be employed in the treatment of diabetes, but it must be prescribed and taken with care, because of the large quantity of carbohydrate, protein and fat which it contains. A glass of milk is drunk so easily that one is apt to forget that it contains 12 grams carbohydrate, 8 grams protein and 8 grams fat. The graphic table given below (Fig. 9) will make this clear. Skimmed milk and buttermilk contain the same quantity of carbohydrate and protein as whole milk, but differ from it in the absence of fat. Thirty

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c.c. (one ounce) of skimmed milk, whole milk or buttermilk contain 1.5 grams of carbohydrate and 1 gram of protein, and 1 quart of milk contains approximately 48 grams carbohydrate and 32 grams protein. Skimmed milk and buttermilk therefore are carbohydrate-protein food. Whey contains carbohydrate, but practically no protein or fat.

Diabetic patients seldom become sugar-free on a milk diet. They may become sugar-free if so little milk is taken that the patient is partially fasting.

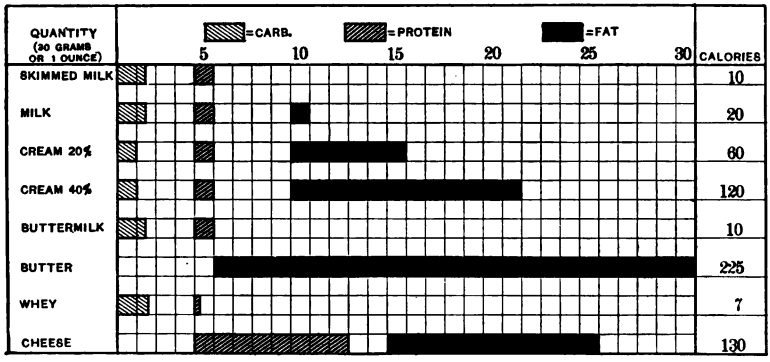

FIG. 9.—Milk and milk products. Carbohydrate, protein and fat in 30 grams or 1 ounce. Each lineal division represents 1 gram.

The high nutritive value of cream, butter and cheese is evident from Fig. 9. This makes these special milk products desirable, but if carelessly taken, danger of acid poisoning arises from the large amount of fat which they contain. The high protein value of milk—1 gram to the ounce, 32 grams to the quart—is important to consider, not alone because of the protein itself, but also because from protein sugar is often formed. Cheese contains about half again as much protein as fish.

Caloric Values which Every Doctor Should Know by Heart.—The quantity of carbohydrate, protein and fat in the diet must be known by physician and patient if a case of diabetes is to be treated in modern fashion. The value of the different

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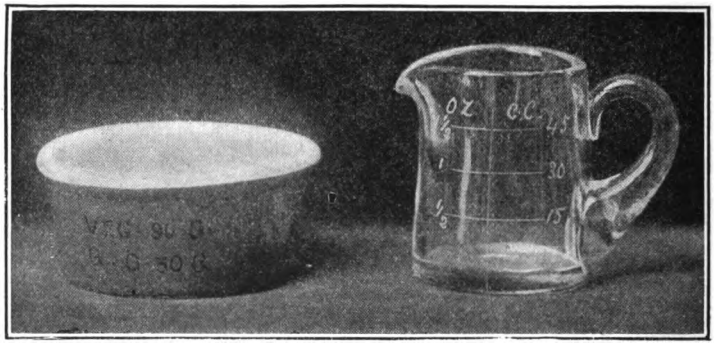
foods in the diet can easily be calculated from Table 10. This is a sufficiently accurate arrangement, because except in the most exact experiments the errors in the preparation of the food are too great to warrant closer reckoning.

Repeatedly physicians and patients have requested me to arrange the common articles of the diabetic diet mentioned in Table 10 in terms of household measure. To a considerable extent this is impracticable, because the diabetic diet deals with so small a quantity of carbohydrate. For this reason the only safe way for diabetic patients at the commencement of their training is to weigh their food. After a few days of weighing, patients can select utensils which conform to the size of the portions of their own special diets and use these exclusively. Two such utensils are shown in Fig. 10.



a *b*

FIG. 10.—*a*, a ramekin this size holds 45 c.c. of water, or 3 tablespoonfuls; *b*, a pitcher graduated to 15 c.c.; capacity, 60 c.c.

The ramekin level full of Quaker Oats holds 30 grams. When packed tightly with 5 per cent. vegetables or potato it holds 90 grams, but when filled loosely in the ordinary manner, 75 grams. The pitcher holds 60 c.c., or 2 ounces, and is graduated to 15 c.c. (Ramekin and pitcher were arranged for me by Jones, McDuffee & Stratton Company, of Boston, Mass.)

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Patients and physicians often err in thinking their computations of the diet are extremely accurate. In order to demonstrate the errors which easily arise from general statements about foods, Fig. 11 is inserted.

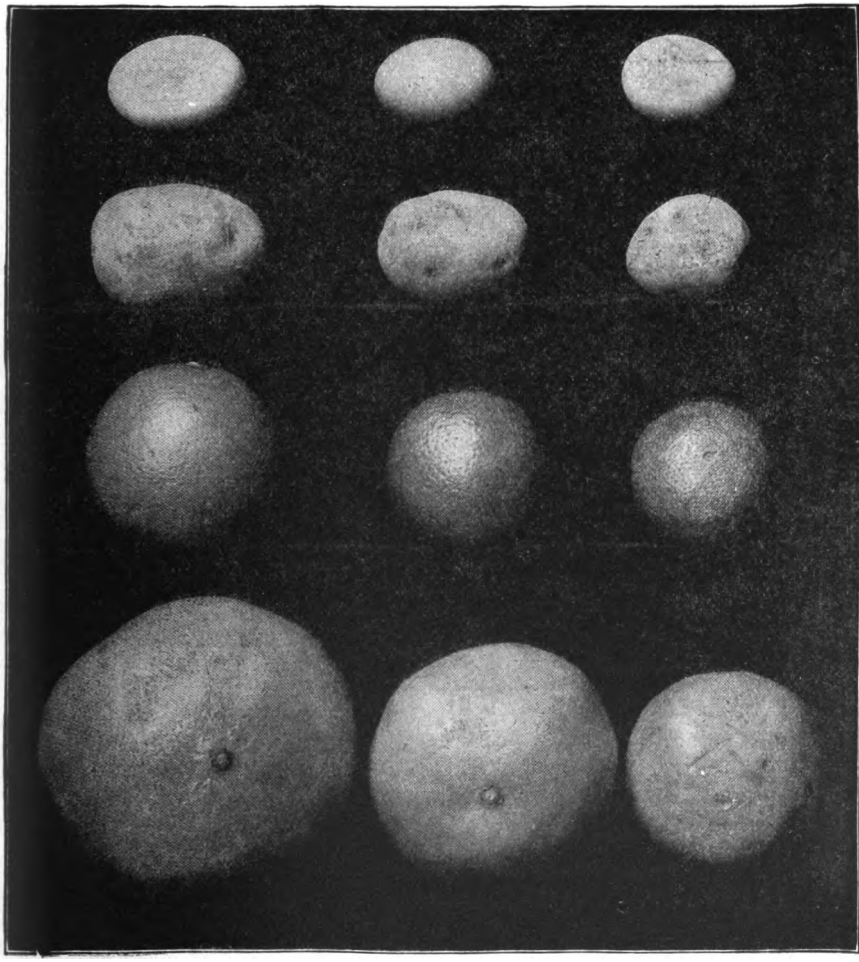

FIG. 11.—Variations in the sizes of common foods.

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Fig. 11 shows:

1. How readily errors may occur in estimating the food values of the diet unless definite quantities of foodstuffs are prescribed.

2. The absurdity of reckoning food values to the fraction of a gram unless actual analyses of each food as served are made.

Errors in eggs may compensate themselves, because the eggs average about 60 grams (and must so average in some communities); errors in potatoes, oranges and grape fruit must necessarily be very great. The largest of the three potatoes is actually a small potato; the potato weighing 60 grams is about the size of an egg; the oranges from left to right are sold under the trade names of 126, 170 and 250 (to the box) and the grape fruit under the trade names of 28, 64 and 96 (to the box).

	Grams.	Grams.	Grams.
Three Eggs.			
Weight of one egg	70	60	50
Protein in one egg	7	6	5
Fat in one egg	7	6	5
Three Potatoes.			
Weight of one potato	120	90	60
Carbohydrate in potato	24	18	12
Three Oranges.			
Weight of one orange	350	225	150
Carbohydrate in one orange	20	15	10
Three Grape Fruit.			
Weight of one grape fruit	900	600	300
Carbohydrate in one grape fruit	40	30	20

It is partly on account of the ease with which large errors in the carbohydrate content of food may occur that it is desirable to give to patients with a low carbohydrate tolerance their carbohydrate in the form of 5 per cent. vegetables exclusively, for an error in weighing, reaching 120 grams (4 ounces), would amount to but a few grams of carbohydrate.

The weights and food values given for the various foods in the illustration are not absolutely but they are approximately correct.

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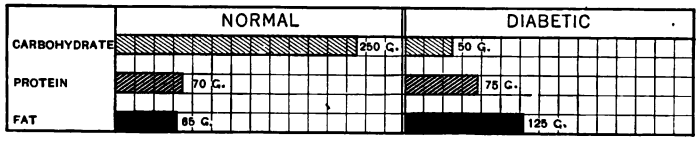
CHAPTER II.

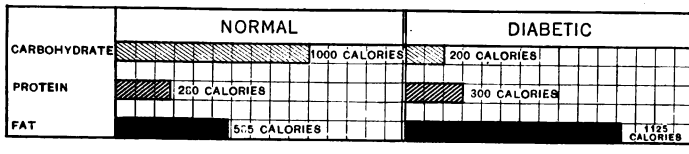
THE DIET OF DIABETIC INDIVIDUALS.

The Normal and Diabetic Diets Compared.—Four-sevenths of the calories of the diet in health are made up of carbohydrate, two-sevenths of fat and one-seventh protein; but in diabetes the diet is composed almost exclusively of the latter two foods. This is not discouraging, for until recently the Eskimo's diet contained only about one-seventh carbohydrate. It takes time and experience to learn to live successfully upon a diabetic diet, and it is only with time that the body adjusts itself to a diet with so marked a reduction of carbohydrate and so marked an increase in fat. It is indeed wonderful that it is possible for the body to do so at all.



Foods arranged in grams.

FIG. 12.—The diet of a normal and of a diabetic individual compared. Weight of each patient 60 kilograms (60 × 2.2 = 132 pounds).



Foods arranged in calories.

FIG. 13.—Same as Fig. 12.

In Figs. 12 and 13 the carbohydrate, protein and fat in the normal and diabetic diets are graphically compared by weight and by calories. It is assumed in this comparison that a

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diabetic patient has a tolerance for 50 grams carbohydrate. It will be noted that the total caloric value of the diabetic diet is slightly less than the normal diet. This is so arranged with design, partly because the diabetic patient is usually less active and partly because, by a slight restriction of diet, the opportunity for improvement of the diabetes is favored.

Caloric Needs of the Diabetic.—The diet of the diabetic patient should contain, except for brief intervals, the minimum number of calories which the normal individual would require under similar conditions. I am convinced that many normal individuals actually live upon less than 30 calories per kilo, and repeatedly one sees diabetic patients over fifty years of age who comfortably live upon less for long periods. This is true for the untreated diabetic. If the patient is allowed more than the minimum amount of food there is far more likelihood that a portion will be unassimilated and appear as sugar in the urine. One of the first rules for the diabetic patient to learn is never to overeat. He should be a model in food conservation for his household. As a matter of fact, during scientific treatment he always returns a clean plate because his appetite is always equal to the food allowed.

Carbohydrate in the Diabetic Diet.—The total carbohydrate in the diet of diabetic patients is almost invariably restricted, and seldom exceeds 100 grams. This is a decrease to approximately 25 per cent. of the normal carbohydrate ration, and so radically changes the composition of the normal diet as to make it self-evident that rapid changes from a normal to a diabetic diet containing even 100 grams carbohydrate might easily cause indigestion in normal as well as in diabetic individuals. The decrease in carbohydrate must be compensated by an increase in fat.

The Estimation of the Carbohydrate in the Diabetic Diet.—The quantity of carbohydrate in various foods is easily calculated and far more simply than is usually thought. (See Table 10, p. 54, and Fig. 7, p. 52, with accompanying text.)

Carbohydrate in Vegetables.—It would appear perplexing to determine the amount of carbohydrate in the various vege-

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tables which the patient eats in twenty-four hours, but this is really not the case. It is true that there is considerable variation in each group in Table 5, but the average content is not far from that represented, the error being on the lower side. This does not hold for string beans, for often trouble occurs from the beans having developed into maturity, thus greatly increasing their content in carbohydrate. Many an unexplained trace of sugar in the urine has undoubtedly occurred in this way.

One will not be very wrong if he considers the total carbohydrate of the 5 per cent. vegetables which a diabetic patient will eat in the twenty-four hours as 10 to 20 grams. This is why in mild cases of diabetes it is unnecessary to weigh the vegetables, for it is improbable that a patient will eat too much of these.

Loss of Carbohydrate in Cooking Vegetables.—Vegetables lose carbohydrate in the cooking, and this loss is favored (1) by changing the water in which they are prepared two or three times, and (2) by preparing the vegetables in finely divided form so that the water can have easy access to the whole mass. Von Noorden[1] pointed out that 100 grams of raw spinach contained 2.97 grams carbohydrate, but cooked spinach only 0.85 gram. Similarly, 100 grams of ripe peaches contained 9.5 grams carbohydrate, but when boiled and the water changed, only 1.8 grams. Allen[2] has utilized this method of removing carbohydrate from vegetables and thus allows patients to have bulk in their diet. He terms vegetables so prepared "thrice-cooked vegetables," though at the present moment it seems more appropriate to term them "camouflage vegetables." "Under these conditions the vegetables may be boiled through three waters, throwing away all the water. Nearly all starch is thus removed. The most severe cases generally take these thrice-cooked vegetables gladly and without glycosuria." Patients often say that it makes little difference to them whether the vegetables are thrice washed or not. It is easy and useful to add

[1] Von Noorden: Die Zuckerkrankheit, Berlin, 1912, p. 306.
[2] Allen: Boston Med. and Surg. Jour., 1915, clxxii, p. 241.

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a little salt, and if desired the vegetables can be flavored with meat juices or meat extracts.

Even when vegetables are cooked in the ordinary way, considerable carbohydrate, protein and, what is quite unfortunate, salts, are lost. Few analyses of cooked vegetables are available, but some of those which I have found are recorded in the following table:

TABLE 19.—THE INFLUENCE OF COOKING UPON THE CONTENT OF CARBOHYDRATE IN VEGETABLES.

Food.	Carbohydrate: Fresh, per cent.	Cooked, per cent.
Asparagus	3.3	2.2
Spinach	3.2	2.6
Beans (string)	7.4	1.6
Beets	9.7	7.4
Carrots	9.2	6.8
Cabbage	5.6	3.7
Greens (beet)	....	3.2
Onions	9.9	4.9
Beets (boiled)	....	10.0
Parsnips	....	13.2
Peas	16.9	14.6
Potatoes	18.4	20.9
Potato chips	....	46.7
Sweet potatoes	27.4	42.1

Through the kindness of Professor Ruth A. Wardall, of the Department of Home Economics of the State University of Iowa, working in Professor Mendel's laboratory in Yale University, I am able to insert Table 20, which shows the carbohydrate in washed vegetables.

The results shown in this table are simply preliminary experiments, but they are of so much value that they deserve attention. Professor Wardall finds it no disadvantage to use the boiling temperature for each of the extractions. In the data recorded below the extractions were made by starting the vegetables in cold water and then bringing this to the boiling-point and maintaining it at this temperature for one minute. Hot water was added for each of the other extractions, and all were boiled one minute. If the first extraction is kept at 150° F., as has sometimes been recom-

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TABLE 20.—ANALYSES OF WASHED VEGETABLES. PROFESSOR RUTH A. WARDALL.

Vegetable.	Spinach.	Celery A, soaked 2 hours in cold water.	Celery B.	Cabbage.	Asparagus, canned.	Mushrooms, Agaricus Campestris.	Cauliflower.	Carrots.	Endive.	Rhubarb	Spinach, canned.
Number of successive extracts.	5	5	5	4	10	5	17	7	12	6	10
Comparative quantity of reducing substance extracted, indicated in decreasing order; by number of extract.	1, 2, 3, 4	1, 2, 3	1, 2, 3	1, 2, 3, 4	1–9	0	1–16	1–6	1–11	1–5	1–9
Number of extract which removes little or no carbohydrate and consequently the number of washings is one less.	5	4	4	..	10	0	17	7	12	6	10

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mended, the second extraction leads the list in removing carbohydrate, the first extraction ranking after the third or fourth. In general, 100 grams of the fresh, clean, dry vegetable, weighed from the edible portion, were used for each analysis, and all calculations were made on this basis. With the exception of canned asparagus the four or five extractions necessary to remove all reducing substances left the vegetables still attractive in flavor and appearance. Professor Wardall has further reported[1] that repeated washings with water will remove the carbohydrate from beets and parsnips; 3 in the case of the beets and 7 in the case of the parsnips.

For practical purposes three extractions will probably be found sufficient. For the first, place the vegetables in cold water and bring the same to the boiling-point, maintaining the temperature for three to five minutes, but for the others begin with hot water.

The Carbohydrate in Various Foods.—1. *Potatoes.*—The variation in the percentage of carbohydrate in potatoes before and after cooking is negligible, save with potato chips, in which it more than doubles. The loss of protein is slight, but if soaked in cold water before boiling the loss of protein is 25 per cent. and of mineral matter 38 per cent. If the potatoes are not soaked but dropped at once into boiling water the loss is much decreased, and if the potatoes are boiled with the skins on the loss is very slight. Emphasis should be laid upon the comparatively small amount of carbohydrate in potato in comparison with its bulk and in comparison with the percentage of carbohydrate in bread. A considerable number of my milder cases of diabetes, by giving up bread and bread preparations entirely, have been able to eat potatoes freely. In prescribing potatoes for diabetic patients it is desirable to designate baked potatoes, for these can be eaten with the skins if pains are taken to have them carefully cleaned with a scrubbing brush in the kitchen. This is advantageous in two ways: the skins are quite an addition to the meager diet of the diabetic, and furthermore, they counteract constipation.

[1] Am. Med. Assn., 1917, lxix, p. 1859.

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2. *Nuts.*—Nuts containing 15 and 20 per cent. carbohydrate are probably far less objectionable than most other foods with a similar carbohydrate content. This is due to the fact that in such nuts as almonds and peanuts a larger part of the carbohydrate is in the form of pentosan, galactan or other hemicelluloses which probably do not readily form sugar.

3. *Fruit.*—Fruit is most desirable for a diabetic patient if his tolerance will allow him to take it. The taste is agreeable, it serves instead of a dessert, and so relieves the patient of the embarrassment of sitting idly at the table when others are eating. The best varieties of fruit for diabetic patients are grape fruit (5 per cent.), strawberries (7 per cent.) and oranges (11 per cent.). These fruits are safer for the patient than apples (15 per cent.), because they contain 5 to 10 per cent. less carbohydrate and are more satisfying. Furthermore, it is less easy thoughtlessly to eat an orange than an apple and thus break dietetic restrictions.

4. *Oranges.*—The quantity of carbohydrate in a small orange is about 10 grams. The same statement will apply to one-half a small-sized grape fruit. One will not be far wrong to consider that one compartment of a small orange contains 1 gram carbohydrate. The illustration on p. 63 shows that larger oranges and larger grape fruit easily contain twice as much carbohydrate as do the smaller varieties.

5. *Bananas.*—Bananas can seldom be taken by diabetic patients because the content of carbohydrate is so high, being equivalent to that in potato. In general, the riper a banana, and for that matter any vegetable or fruit, the more the starch in it has changed to sugar, and also the more carbohydrate it contains. Since unripened fruits with their lower carbohydrate content can be made palatable by cooking, a way is afforded for diabetic patients to use them.

6. *Ripe Olives.*—Ripe olives make a pleasing change in the diet. They contain 4 per cent. carbohydrate in contrast to green olives, which contain 1.8 per cent. Furthermore, ripe olives are more easily digested. Five ripe or ten green olives contain 1 gram carbohydrate and 5 grams of fat. The quantity of protein in ten olives is about 1 gram.

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7. *Milk.*—The carbohydrate in milk is in the form of lactose and can be reckoned at 5 per cent., or 1.5 grams per 30 c.c. or 1 ounce. It is the same in skimmed milk, buttermilk and whey; but cream and koumiss contain about 3 per cent., or 1 gram carbohydrate to the ounce. Buttermilk contains essentially the same quantity of carbohydrate and protein as milk, but only a trifling amount of fat. I cannot understand why doctors so frequently give it to their patients.

8. *Oatmeal.*—Oatmeal is two-thirds carbohydrate. In calculations one should always be guided by the dry weight, because the different preparations vary greatly in bulk and weight when cooked. It is a simple matter for a few days to weigh out 30 grams (1 ounce) of dry oatmeal containing 20 grams carbohydrate, have it cooked and note the bulk. By dividing the oatmeal thus cooked into four portions each would contain 5 grams carbohydrate.

In weighing foods one should never attempt to weigh out quantities as small as 5 grams with the usual variety of scales. A more reliable result is obtained by weighing out multiples of 5 grams and then dividing into enough portions to make each portion 5 grams.

9. *Bread.*—The carbohydrate in white wheat bread amounts to about 53 per cent. If the bread is toasted, enough water is lost to raise the percentage of carbohydrate in the toast to about 60 per cent. If the bread is made without sugar and with water instead of milk the carbohydrate content is lowered and may amount to only 45 per cent. Coarse breads if made without sweetening or milk would contain slightly less carbohydrate. It is undesirable to give bread to diabetic patients unless their tolerance is very high, because they can take so little without causing glycosuria that the bread is simply an aggravation. An error in weight of 1 ounce of a 5 per cent. vegetable amounts to 1 gram carbohydrate, of potato to 6 grams, but of bread to 18 grams. Crackers and zweiback contain still less water than toast, and in consequence the percentage of carbohydrate is raised to the neighborhood of 70 per cent. Many gluten breads upon the market contain as much as 30 per cent. carbohydrate.

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Protein in the Diabetic Diet.—The quantity of protein required by diabetic patients varies with the age, weight and activity of the case as well as with the condition of the kidneys. It is a safe rule at the beginning of treatment to attempt to increase the protein gradually up to the same quantity as that required by a normal individual.

Chittenden points out that 60 grams (one-half the old standard protein) are quite sufficient to meet all the real physiological needs of the body under ordinary conditions of life and with most individuals not leading an active out-of-door life even smaller amounts will suffice. Chittenden, weighing 57 kilograms, and Mendel weighing 70 kilograms, lived respectively on 34 and 41 grams protein daily, the former for nine and the latter for seven months. Until the Chittenden low-protein diet is proved to be entirely satisfactory for healthy individuals over a long period of years it is best not to have recourse to it for long periods in the treatment of diabetes. Temporarily small quantities may be given, but safety lies not far from 1 gram protein to each kilogram body weight.

It has been claimed that vegetable proteins give rise to less carbohydrate than do animal proteins. As a matter of fact, carbohydrate may be formed out of any protein.

Meat and Fish.—The study of the chemical composition of meat and fish is simplified for the diabetic patient by the fact that except in liver and shell-fish, carbohydrate is absent. Even in liver the quantity of carbohydrate is almost negligible when we consider the amount and frequency with which this article of food is eaten. The analyses of liver and shell-fish will be found in the tables on pages 150 and 151.

The chief difficulty in computations of the nutritive value of meat and fish is due to the varying content of fat. Thus, the edible portion of chicken may contain on the average only 2.5 per cent. of fat, whereas lean ham may contain 14 per cent. of fat, fat ham as much as 50 per cent., and smoked bacon 65 per cent., though lean smoked bacon 42 per cent. In general, a mixture of cooked lean meats probably contains not far from 10 to 15 per cent. of fat.

Fish differs from meat chiefly in the small quantity of fat.

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Even salmon, which contains more fat than most other fish, showed in its analysis only 12.8 per cent. fat, shad 9.5 per cent. and herring and mackerel 7.1 per cent. In general, other kinds of fish show 6 per cent. or less of fat. Halibut steak, for example, contains 5.2 per cent. and cod 0.4 per cent. Preserved fish, however, is quite rich in fat; thus sardines contain 19.7 per cent. In substituting fish for meat, my patients are taught to add from ½ to 1 teaspoonful of olive oil to the diet for each 30 grams of fish.

The quantity of protein in meat also varies considerably and usually falls as the percentage of fat rises. A value of 20 per cent. for protein in uncooked lean meat represents about the average and this is increased to 25 per cent. or more when the meat is cooked. The quantity of protein in fish is very slightly less than that in meat. Fish is especially desirable in the early days of protein feeding following the preliminary carbohydrate-feeding days, because in fish the quantity of fat is so low. Shell-fish make agreeable additions to the diet: (1) they are desirable because they are palatable; (2) they are bulky foods and so are satisfying; (3) they furnish a separate course at a meal. Half a dozen oysters or clams are quite sufficient. The edible portion of a medium-sized oyster on the shell weighs on the average half an ounce, and half a dozen oysters would amount to 90 to 100 grams. The six would contain about 4 grams carbohydrate, 6 grams protein and 1 gram fat, the equivalent of 50 calories. Half a dozen clams on the shell (edible portion) weigh 35 grams and contain 0.7 gram carbohydrate, 3 grams protein, and a negligible quantity of fat.

Broths.—Broths are so extensively used on fasting days and for lunches for diabetic patients that their composition deserves notice. As a rule the nutritive value of a broth made for diabetic patients should be negligible. That this may be the case the broth should be skimmed free of fat, and obviously should be clear so as to be free from particles of meat fiber. The broths should be thin, because a jelly-like broth would contain a large quantity of protein in the form of gelatin, and I have known such broths to prevent diabetic patients from rapidly becoming sugar-free when

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they were allowed broths freely on otherwise fasting days. Canned meat extracts contain very little nourishment. The danger in broths lies in the amount of salt which they contain. Frequently this is very great, whereas the amount of salt should be moderate. Patients often desire to drink several cups of broth a day, and if the broth is heavily salted all the salt is not excreted, but remains in the body and retains with it so much liquid that weight is increased, and swelling of the legs or even of the face may develop. (See pages 79 and 108.)

Fat in the Diabetic Diet.—Fat forms the bulk of the diabetic patients' diet. Even with the most modern ideas upon treatment this statement holds. Figs. 7 (p. 52), 12 and 13 (p. 65), and Table 16 give the proportions which the different foodstuffs take in the diet and show the extent to which diabetic patients must depend upon fat to offset the loss of carbohydrate. Remember that the diet of a healthy individual of 70 kg. at office work contains approximately 300 grams carbohydrate, yielding (300×4) 1200 calories, and if nearly all this quantity is unutilized by the diabetic patient, it can be calculated how many calories in the form of fat must be given to replace it. Theoretically, these 133 grams $\frac{(1200)}{9}$ fat should be taken in addition to the usual 100 grams of fat in the normal ration; but practically this is seldom necessary, partly because the diabetic patient is usually less active than the ordinary individual. Furthermore, most diabetic patients have a tolerance for quite a considerable quantity of carbohydrate. Finally, these calculations are made for a patient weighing 70 kilograms. In reality most diabetic patients weigh far less and therefore require less food.

The Eskimos live largely upon fat. Diabetic patients should be very thankful that there is a race of Eskimos through which proof is afforded that it is perfectly possible to maintain life on a diet in which carbohydrate is largely replaced by fat.

How much fat should a diabetic patient eat? This does not depend upon the capacity of the digestion. The safest

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answer would be: as little as possible in order to maintain body weight. Unquestionably the quantity will vary from time to time, and it may increase with years without detriment to the patient. Nevertheless I am always glad to see a diet which contains as much or half as much carbohydrate as fat; in other words, a carbohydrate-fat ratio of 1 : 1 or 1 : 2, respectively, and dread to see one with a carbohydrate-fat ratio of 1 : 5 or above.

Fat is most agreeably taken as cream, and cream which contains 20 per cent. butter fat is usually easier to bear than a richer cream. It is seldon advisable to allow more than half a pint (240 c.c.) of cream, although patients prefer to increase the quantity of cream at the expense of other forms of fat in the diet. There is no other form of food from which a diabetic patient can derive more pleasure for its caloric value and yet with less harm to himself than from cream. Half a pint of 20 per cent. cream contains 48 grams of fat, and yet the quantity of carbohydrate or of protein in cream of this richness is but little over 8 grams, and may be estimated in clinical work as 8 grams, or 1 gram to the ounce. Occasionally patients tolerate butter more readily than cream, and, as a rule, fresh unsalted butter is preferred. Obviously, when cream is increased in the diet, the butter must be decreased, and *vice versa*. Thirty grams of butter contain 25 grams of fat, and this is a welcome addition to the diet. Oleo, butterine and nut margarine contain no sugar and have about the same percentage of fat as butter and the cost is very much less. Lard being nearly 100 per cent. fat can be used to advantage more than it now is in the diabetic's diet. Crisco, also nearly 100 per cent. fat, is often more welcome than lard, because of its lack of flavor. Oil is an ideal diabetic food, because it is a pure fat. Oil is so desirable for a diabetic that I hesitate to have a patient take more than 15 grams (1 tablespoonful), lest he weary of the same. If oil is disliked upon vegetables it can be taken in small quantities after meals as a medicine. Italian patients naturally bear olive oil unusually well. Olive oil forms an excellent lunch for diabetic patients. I frequently advise its use upon retiring. It is the diabetic patient's cough

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medicine; it relieves the symptoms of his hyperacid stomach. Peanut, corn or cotton-seed oil may be substituted if expense is a factor.

The Danger of Fat to the Diabetic.—Fat is the chief source of the dreaded acidosis, though to this in lesser degree the amino-acids of the protein molecule with even numbers of carbon atoms contribute as well. Fat, therefore, at one time may save the life of the diabetic, but at another period may destroy it. The close dependence of acidosis upon a fat diet is beautifully shown in Table 21.

TABLE 21.—THE DEPENDENCE OF ACIDOSIS UPON THE FAT IN THE DIET (WILLIAMS AND DRESBACH.)

Date.	Urine.			Diet.		
	Diacetic acid.	Total NH_3 (Folin), grams.	Total sugar (polar), grams.	Carbohydrate, grams.	Protein, grams.	Fat, grams.
1912						
July 5	++	1.9	48	20	100	200
6	++	2.1	27	65	100	200
27	+	0.6	30	90	33	74
Aug. 8	++	2.7	86	190	75	200
Oct. 20	+	0.6	45	64	75	30
31	0	0.3	38	45	75	30
Nov. 12	0	0.5	56	56	75	30
1913						
Jan. 28	+++	2.6	122	35	100	200
Feb. 2	+++	3.0	152	66	90	200
June 12	++++	4.1	108	90	100	200
July 27	++++	4.4	123	200	150	180+
31	++++	3.3	172	200	150	180+

There is no more potent agency in the prevention of acidosis than the withdrawal of fat from the diet. Allen has made us all his debtors by a series of experiments upon diabetic dogs which show the insidious way in which fat is harmful in the manner in which it has been customarily employed in the treatment of diabetes. "Fat unbalanced by adequate quantities of other foods is a poison."

Alcohol.—The use of alcohol in diabetes would seem to be indicated, but, as a matter of fact, there is but a small per-

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centage of my patients who employ it at all. Theoretically, 1 c.c. of pure alcohol yields 7 calories in its combustion. Thus, 15 c.c. (1 tablespoonful) of alcohol or its equivalent —30 c.c. (2 tablespoonfuls) of whisky, brandy, rum, or gin— would yield 105 calories to the body. Seldom, however, do I prescribe it for patients, and this rule holds even for patients during days of fasting, Most of the physicians with whom I am acquainted treat a large majority of their patients without alcohol in any form.

Liquids.—It is rarely necessary to restrict the liquids in diabetes. The diminution of the carbohydrate in the diet with the resulting fall in the excretion of sugar usually leads to a corresponding diminution in the thirst and quantity of urine. I hesitate to restrict liquids in severe diabetes for fear too little liquid will be available for the body with which to eliminate the acids which may have been formed. On the other hand, patients often upset the digestion by drinking large quantities of liquids rapidly. This is avoided by allowing only half a glass of liquid at a time, though the patient is instructed to take that as frequently as desired. Case No. 1196 continually voided large quantities of urine, but usually I could find a cause such as the ingestion of 20 or more grams of salt, bouillon cubes in variable number or 21 half-grain saccharin tablets a day. Ice-water should be discouraged.

Sodium Chloride.—Salt is of great service to the diabetic patient. If it is withdrawn from the diet the weight falls, due to the simultaneous excretion of water, and the skin and tissues of the patient are obviously dry.

In the early days of fasting treatment, patients often lost much weight because water alone was allowed. For example, I learned of one case who lost thirteen pounds in four days in this manner. When broths are freely given during fasting it is not uncommon, particularly in the presence of acidosis, to see a patient gain weight, and invariably such patients feel better than those who lose.

Salt is very freely used by diabetic patients. I do not remember to have ever seen a diabetic patient who took too little salt. One of my fasting cases was accustomed to

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shake it into his hand to eat. Patients will often salt their broths, although they contain considerable salt.

The fact that it is harmful for a diabetic patient to take large quantities of salt is frequently shown by the excessive quatities of urine which they are obliged to void, though sugar-free, and by the swelling which may appear in legs and ankles. However, it should be stated that I have never known a patient with dropsy to develop diabetic coma, and I recall but one instance of a patient in diabetic coma in whom dropsy appeared. The withdrawal of salt from the diet of Case No. 1378 wrought surprising changes in her weight and her dropsy entirely disappeared. From 98 pounds it fell to 70 pounds in twenty-five days and this was due almost exclusively to the disappearance of the dropsy.

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CHAPTER III.

THE TREATMENT OF MODERATELY SEVERE AND SEVERE CASES OF DIABETES.

THE object of diabetic treatment is to enable the patient, by rearrangement of his diet and habits of life, to live in a manner similar to that of the healthy individual. This object is best attained by preventing the loss of sugar in the urine—in other words, by keeping the urine sugar-free. Cases Nos. 804, 1024, 894, 564 and 632 illustrate successful treatment.

Case No. 804 contracted diabetes at the age of forty-two years, and first consulted me four years later, December 17, 1914, at the age of forty-six. His weight at that time was 139. The quantity of sugar amounted to 5.6 per cent., and acid poisoning was present. With restriction of diet and fasting he became sugar-free on December 30, and the acid poisoning disappeared on January 7. He left the hospital sugar-free, having gained one pound by January 11, and a year later his weight was 150. Difficulty occurred in keeping sugar-free, and he returned for hospital treatment on April 22, 1917, showing in a twelve-hour specimen 2.5 per cent. (66 grams) of sugar and severe acid poisoning. In Table 22 it will be seen that even four days of fasting did not suffice to rid the urine of sugar. This was followed by three days of restricted diet, when the institution of one fast day made the urine sugar-free. On May 18 he left the hospital free from acid poisoning and sugar, and weighing 134 pounds. His diet then contained carbohydrate 15 grams, protein 71 grams, fat 122 grams, and alcohol 12 grams, making a total of 1526 calories. By August 17 he had been able to increase the diet to 50 grams carbohydrate, about 110 grams protein, and 110 grams fat, making 1600 to 1800

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TABLE 22.—CASE NO. 804. A SEVERE CASE TREATED BY FASTING WHO SUBSEQUENTLY INCREASED HIS TOLERANCE FOR CARBOHYDRATE TO A REMARKABLE DEGREE.

Date, 1917.	Diacetic acid.	Ammonia, total grams.	Sugar.		Diet in grams.					Carbohydrate, balance grams.	Naked weight, pounds.	Blood sugar per cent.
			Reduction per cent.	Total grams.	Carbohydrate.	Protein.	Fat.	Alcohol.	Calories.			
Specimen												
April 21	++++	....	2.8	—	—	—	—	—	—	—		
21–22	++	....	2.5	66	—	—	—	—	—	—	132	
22–23	++	....	1.3	35	0	0	0	0	0	−35	130	
23–24	++	2.2	0.8	14	0	0	0	0	0	−14	129	0.22
24–25	+	2.3	0.8	12	0	0	0	0	0	−12	130	
25–26	0	1.8	0.1	2	0	0	0	0	0	− 2	131	
26–27	0	....	0.1	3	0	30	6	9	237	− 3	132	
27–28	+	....	0.1	3	0	46	22	12	466	− 3	132	
28–29	0	....	0.2	6	0	51	37	12	621	− 6	132	
29–30	0	....	0	0	0	0	0	30	210	0	132	
30– 1	+	....	−0.1	0	0	35	33	18	563	0	133	0.15
May 1– 2	sl. +	....	−0.1	0	0	50	47	9	886	0	133	
2– 3	sl. +	....	0.1	2	0	58	50	12	766	− 2	134	
3– 4	sl. +	....	0	0	0	60	59	15	876	0	134	
4– 5	sl. +	....	0	0	1	60	72	12	976	+ 1	134	
5– 6	0	....	0	0	5	63	84	18	1154	+ 5	135	
6– 7	0	....	0	0	9	63	92	9	1179	+ 9	134	
7– 8	0	....	0.2	4	10	65	106	9	1317	+ 6	135	0.15
8– 9	0	....	0	0	0	0	0	12	84	0	133	
9–10	0	....	0	0	9	63	94	12	1218	+ 9	136	
10–11	0	....	0	0	9	62	94	9	1193	+ 9	136	
11–12	0	....	0	0	9	62	91	3	1124	+ 9	136	
12–13	0	....	0	0	9	73	94	6	1216	+ 9	135	
13–14	0	....	0	0	9	68	91	9	1190	+11	136	0.10
14–15	0	....	0	0	11	70	106	12	1362	+13	134	
15–16	0	....	0	0	13	75	118	9	1477	+15	134	
16–17	0	....	0	0	15	71	122	12	1526	+15	134	
17–18	0	....	0	0	15	71	122	12	1526	+15	135	0.11
Aug. 17	0	....	0	0	50	110	110	....	1630	+50		

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calories in a day, and the weight had risen to 148 pounds. From the above it can be seen that the diabetes changed from the severe to the moderate type, and finally became mild.[1]

Case No. 1024 consulted me at the age of seventy-seven years with a history of diabetes of eight years' duration. She was annoyed by symptoms referable to the circulation, digestion and skin, and her age and discomfort suggested that it might not be worth while to attempt any treatment. Treatment, however, was attempted, and rewarded by the urine becoming sugar-free and remaining so at the end of three weeks, but only upon a rigid diet containing 1 gram carbohydrate, 32 grams protein, 72 grams fat, and alcohol 12 grams. Even upon this stern regime the urine remained sugar-free for only a few weeks, when sugar reappeared in varying quantities. But no one even thought of giving up the fight for health. Under the careful supervision of skilled nurses, sugar disappeared again, and the weight, which had fallen from 122 pounds to 106 pounds in August, 1916, steadily increased to 119 pounds the following summer and the patient remained sugar-free over a period of months, with a diet containing carbohydrate about 40 grams, protein 75 grams and fat about 140 grams. The blood-pressure, which was 160, is now 125; Mrs. ——— now looks well and is more active than any woman I know of her age. This patient, apparently a severe case of diabetes, with distressing symptoms, under careful treatment has changed to a case of almost mild type.

Occurring at the other extreme of life is Case No. 894, a little girl, who developed diabetes at the age of one year and five months, although it was not discovered until a year later. In March, 1915, the urine showed 5.3 per cent. of sugar, although when I first saw her (July 30, 1915) she was upon a restricted diet, and but 0.2 per cent. was found. Under careful treatment she has remained sugar-free except during a brief period in midsummer of 1917, when confusion

[1] I consider the diabetes to be *severe* when sugar appears in the urine if the diet of the patient contains not over 10 grams carbohydrate, *moderate* if between 10 and 50 grams carbohydrate, and *mild* if more than 50 grams.

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existed as to the solution used for testing the urine, and the diet had been unfortunately increased. With little trouble, however, she again became sugar-free. The weight on August 3, 1915, was 33¼ pounds, and on August 12, 38½ pounds.

One of the most satisfactory cases, Case No. 564, whom I have had under observation was a boy of sixteen, who came to my then assistant, Dr. F. Gorham Brigham, in November, 1912. Sugar had appeared in the urine without previous symptoms following a football game between two large preparatory schools. The patient entered the New England Deaconess Hospital, where, under the methods of treatment adopted in 1912 and 1913, he remained from December 15, 1912, to January 14, 1913, without becoming sugar-free, the quantity of sugar varying between 3.4 per cent. (187 grams in the twenty-four hours) to 0.8 per cent. (43 grams in the twenty-four hours) at discharge. However, with the methods adopted at that time, under the supervision of Dr. R. J. Thompson, of Fall River, and a nurse thoroughly versed in diabetic treatment, the acid poisoning, which had been severe and later amounted to as much as is represented by 5.7 grams ammonia in twenty-four hours, disappeared, and at his home he became sugar-free in April, 1913. He has now passed a considerable portion of his examinations for college, and should enter this coming year. On September 23, 1916, the urine was sugar-free and the blood sugar amounted to 0.13 per cent. His weight naked was 129¾ pounds in contrast to 97½ pounds on December 17, 1912. On December 26, 1916, the dressed weight was 134 pounds. On December 27–28, 1917, the urine showed 0.3 per cent., or 6 grams sugar. The blood sugar was 0.23 per cent. and the blood fat 0.704 per cent. It is interesting to record this case, because persistent treatment faithfully followed by doctor, nurse and patient's family has given remarkable results.

Case No. 632, a young officer, aged thirty-five years, with diabetes of one and a half years' duration, came to me first in 1913. At the hospital diacetic acid showed repeatedly, and the ammonia was 1.7 grams, but the tolerance for carbohydrate lay between 15 and 30 grams. Nevertheless, he was discharged with 0.5 per cent. of sugar in the urine, and diacetic

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acid was present, with a diet of 30 grams carbohydrate and a limited quantity of protein, though with an unlimited amount of fat. He returned in February, 1916, and it required twelve days to rid the urine of sugar and twenty-one days to rid it of acid, but he left the hospital April 13, having been sugar-free the preceding week with a tolerance for 28 grams carbohydrate, 79 protein, 133 fat and 9 alcohol. The blood sugar was 0.21 per cent. While at the hospital exercise was utilized to the limit, and, as to be expected of an army man with a Victoria Cross, obedience was implicit, coöperation ever present and system exact. I have permission to publish this letter received eleven months after leaving the hospital.

MARCH 8, 1917.

"I have really been wonderfully well, feel splendid and everyone remarks how well I am looking. Tests have shown a slight trace of sugar on three mornings since October 8 last; all other times absolutely sugar-free. My weight doesn't change at all—if anything I have gotten very slightly lighter. I weigh from 124½ to 125½ pounds. I still stick absolutely rigidly to my routine, but I have gotten up to 30 grams carbohydrate per diem—that is, on the last five days of the week I take 30—rest of diet the same. The last three weeks I have been taking 15 grams oatmeal for breakfast on Monday, Tuesday, Thursday, Friday and Saturday mornings, Wednesday all carbohydrate in 5 per cent. vegetables and cream, Sunday (fast day) all carbohydrate in 5 per cent. vegetables."

That this improvement continues is evident from another letter of October 12, 1917.

"We had a patriotic golf match here last Saturday and Monday against the rival golf club here. I was chosen to play 2d for the———and my opponent and I came out even in both our matches, one over our course and the other over the———. I am sending you a newspaper clipping of the last game at———, just to let you see that there is some life in the old dog yet. Since our game Mr. ——— won the club championship of the ———.

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"I keep very well, as you may surmise from the above, sugar-free all the time. I stick to the same old routine—30 to 31 grams carbohydrate per diem. I gave up the orange, as I really prefer the 5 per cent. vegetables, and I thought that I took the vegetables better. I had a fine five days the end of September, up in the woods, trout fishing, had good weather and very good fishing. I managed to keep sugar-free all the time, although I had a good appetite and took lots to eat."

February, 1918, the patient continued in good condition, sugar-free with tolerance as before.

In what follows the general principles underlying the treatment of moderately severe and severe cases of diabetes are explained. It will be seen that there are many means by which the urine of a diabetic patient may be freed from sugar, but that the simplest of all is by fasting, and to this all other methods converge. If fasting for a day or two appears inadvisable, the simple omission of fat, which materially reduces the nutritive value of the diet, may render the patient sugar-free. Formerly, physicians endeavored to get their patients sugar-free by the reduction of carbohydrate in the diet, at the same time immediately increasing the fat and protein to make up for the calories thus lost. Various dangers attended this practice, and at present it is generally abandoned. The method now adopted to free the urine of sugar is designed to accomplish this end without any risk to the patient. It is brought about either by complete fasting or by the withdrawal of fat from the diet, and the subsequent reduction of carbohydrate and protein to a point at which the patient no longer voids sugar in the urine. Frequently I am in the habit of combining both methods, for it so often happens that by the adoption of the plan about to be described under "Preparation for Fasting" that a patient becomes sugar-free within a few days, and free from acid poisoning if that were present. By methods like the above alkalis are unnecessary, and, indeed, I believe if they are given that they do harm. In the following paragraphs in italics the plan is summarized:

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TABLE 23.—FASTING IN A SEVERE DIABETIC ACCUSTOMED TO A LOW DIET. CASE NO. 1025. (See page 87.)

Date, 1916.	Urine.			Diet in grams.				Weight.	Dietary prescriptions in grams.							Blood sugar, per cent.	Alveolar air, CO_2, mm. Hg.
	Diacetic acid.	Sugar.		Carbohydrates.	Protein.	Fat.	Calories.		Vegetables 5 per cent.	Fish.	Eggs.	Bacon.	Butter.	Cream, 40 per cent.	Lister muffin.		
		Per cent.	Total, grams.														
April 13–14	+++	4.4	97	—	—	—	—	—	—								
14–15[1]	+++	1.2	13	0	0	0	0	94	0	..	..	..	..	..	..	..	26
15–16	+++	0.7	8	0	0	0	0	—	0								
16–17	++	0.2	3	0	0	0	0	92	0	..	..	..	..	..	..	..	26
17–18	+	0	tr.	0	0	0	0	—	0	..	..	..	..	..	..	0.28	29
18–19	sl. +	0	0	0	0	0	0	—	0	..	..	..	..	..	..	..	30
19–20	sl. +	0	0	5	3	0	32	—	150	..	..	..	..	..	..	..	30
20–21	sl. +	0	0	10	5	0	60	94	300	..	..	..	..	..	..	..	29
21–22	+	0	0	20	10	0	120	95	600	..	..	..	..	..	..	..	31
22–23	0	0	0	30	15	0	180	97	900	..	..	..	..	..	..	..	36
			Two	weeks	later,	on	discharge.										
May 9–10	0	0	0	12	..	..	1218	87	300	90	3	45	30	60	2	0.15	

[1] Partial day.

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PREPARATION FOR FASTING.—*In severe, long-standing, complicated, obese, and elderly cases, as well as in all cases with acidosis, or in any case if desired, without otherwise changing habits or diet, omit fat, after two days omit protein, and then halve the carbohydrates daily until the patient is taking only 10 grams; then fast. In other cases begin fasting at once.*

FASTING.—*Fast four days, unless earlier sugar-free. Allow water freely, tea, coffee, and thin, clear meat broths as desired.*

It is important for the patient to observe how his physician frees the urine from sugar in his particular case, because later, if sugar should return, he should follow the same plan by himself.

An example of fasting treatment is shown in Table 23. This patient was twenty-two years of age and had previously been accustomed to a low diet, but had neglected treatment, and returned for hospital care with 4.4 per cent. of sugar and in a serious condition with much acid poisoning. This is shown by the diacetic acid in the urine being recorded + + +, four + signs (+ + + +) being the maximum according to my scale. It will be observed that during one day of fasting the quantity of sugar dropped from 97 to 13 grams, and the percentage of sugar to 1.2 per cent. During the second day of fasting, 8 grams of sugar were excreted, merely a trace on the fourth day, and the fifth day of fasting made the patient sugar-free.

Table 24 shows how Case No. 938, a child, aged two years and four months, became sugar-free in two days with a moderately restricted diet for the first day, and with fasting for the second day.

TABLE 24.—CASE NO. 938. AGED TWO YEARS, FOUR MONTHS. ONSET SEPTEMBER, 1915.

Date.	Urine.		Diet.
	Diacetic acid.	Sugar, per cent.	
1915.			
October 25	0	7.6	Diet unrestricted.
October 25–26	0	3.2	Diet moderately restricted.
October 26–27	+	0	Fasting.

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It will be observed that diacetic acid appeared October 26 and 27. In 1915 I did not appreciate the necessity of completely omitting fat prior to fasting. I doubt if this appearance of diacetic acid would occur at present, because during the last two years measures taken for the safety of the patient at the beginning of treatment have increased enormously.

One of the most satisfactory cases which I have treated was a man, Case No. 1237, aged thirty-nine years, who looked like a severe diabetic, but proved to be a moderate one, with whom the following simple schedule of diet worked admirably.

It will be seen that the patient did not fast at all, maintained a high quantity of protein in his diet, and yet he became sugar-free on the seventh day of treatment without the development of acid poisoning. Although he did not enter the hospital, he came to the office each day until the urine was sugar-free. The case is all the more remarkable because the duration of the disease before treatment was a year and a half. In consequence of his lack of treatment, his weight had fallen from 210 pounds to 142 pounds. (Compare this case with Case No. 653, described in Part I, Chapter 2, p. 22, for whom treatment was begun early.) When first seen the sugar in the twenty-four-hour quantity of urine of Case No. 1237 was 336 grams. The directions given the patient may be summarized as follows:

1. Take ½ pound (240 grams) 5 per cent. vegetables, ¼ pound (120 grams) fish, and one small orange at each meal for two days.

2. On the third day omit half and on the fourth day all the orange.

3. When sugar-free, exchange ¼ pound (4 oz. = 120 g.) fish for 3 ounces (90 g.) meat and next replace another ¼ pound fish by 4 eggs.

4. Then replace 2 eggs with 2 ounces (60 g.) bacon and subsequently add ½ ounce (15 g.) butter a day for two days, to be followed every other day by the addition of 1 ounce (30 c.c.) of 20 per cent. cream until 3 ounces are taken.

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TABLE 25.—ILLUSTRATION OF AMBULATORY TREATMENT WITHOUT FASTING OR OMISSION OF PROTEIN. CASE NO. 1237. AGE AT ONSET IN SEPTEMBER, 1915, THIRTY-NINE YEARS AND FIVE MONTHS.

Date, 1917.	Urine.			Diet in grams.				Weight, pounds dressed.	Dietary prescriptions in grams.							Dietary prescriptions in ounces.						
	Diacetic acid.	Sugar.		Carbohydrate.	Protein.	Fat.	Calories.		Vegetables, 5 per cent.	Fish.	Orange.	Meat.	Eggs.	Bacon.	Butter.	Cream, 20 per cent.	Vegetables, 5 per cent.	Fish.	Orange.	Meat.	Eggs.	Bacon.	Butter.	Cream, 20 per cent.
		Per cent.	Total, grams.																					
Feb. 17	0	8.4	336																					
19	0	2.2	33	54	84	0	....	...	720	360	3	..	..	..	..	..	24	12	3					
20	0	1.8	27	54	84	0	....	...	720	360	3	..	..	..	..	..	24	12	3					
21	0	1.8	23	39	84	0	....	142	720	360	1½	..	..	..	..	..	24	12	1½					
22	0	0.4	6	24	84	0	432	...	720	360	0	..	..	..	..	..	24	12	0					
23	0	0.2	3	24	84	0	432	...	720	360	0	..	..	..	..	..	24	12	0					
24	0	Tr.	0	24	84	0	432	...	720	360	0	..	..	..	..	..	24	12	0					
25	0	Tr.	0	24	84	15	567	139	720	240	0	90	..	..	..	..	24	8	0	3				
26	0	0	0	24	84	39	783	...	720	120	0	90	4	..	..	..	24	4	0	3	4			
27	0	0	0	24	82	57	937	...	720	120	0	90	2	60	..	..	24	4	0	3	2	2		
Mar. 1	0	0	0	24	82	82	1162	...	720	120	0	90	2	60	30	..	24	4	0	3	2	2	1	
3	0	0	0	26	84	94	1286	138	720	120	0	90	2	60	30	60	24	4	0	3	2	2	1	2
6	0	0	0	32	85	106	1422	...	720	120	½	90	2	60	30	90	24	4	½	3	2	2	1	3
9	0	0	0	42	85	106	1462	136	720	120	1½	90	2	60	30	90	24	4	1½	3	2	2	1	3
13	0	0	0	54	87	168	2076																	

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5. Similarly, thereafter every other day add one-half an orange until one-half is taken at a meal and from then on every other day 1 ounce potato until as much as desired is taken, or sugar appears.

Case No. 979, a woman, aged forty-nine years, developed diabetes at the age of thirty-two. When I first saw her seventeen years later, January 26, 1916, she showed 7.4 per cent. of sugar and no diacetic acid. It will be seen from Table 26 how she became sugar-free without the development of acidosis by the elimination of fat and the restriction of protein, followed by the gradual diminution of carbohydrate.

TABLE 26.—CASE NO. 979, OF SEVENTEEN YEARS' DURATION, ILLUSTRATES (1) HOW PREPARATORY TREATMENT MAKES FASTING UNNECESSARY AND (2) RENDERS THE URINE SUGAR-FREE WITHOUT THE APPEARANCE OF ACID POISONING.

Date, 1916.	Urine.			Diet in grams.				Weight, pounds.	Dietary prescriptions in grams.								
	Diacetic acid.	Sugar. Per cent.	Sugar. Total, grams.	Carbohydrate.	Protein.	Fat.	Calories.		Vegetables, 5 per cent.	Grape fruit.	Orange.	Potato.	Bread.	Apple.	Meat.	Oysters.	Fish.
Jan. 25	0	7.4															
25–26	0	6.2	54	..	..	..	..	130									
26–27	0	5.6	83	142	48	16	944	128	300	1	1.0	90	100	1	90	6	
27–28	0	4.0	70	112	43	16	764	128	300	1	1.0	90	50	1	90	6	
28–29	0	2.2	26	72	38	16	584	128	300	1	2.0	90	0	0	90	6	
29–30	0	1.0	14	50	28	11	411	127	300	1	1.0	30	0	0	60	6	
30–31	0	0.6	8	40	28	11	371	127	300	1	0.0	30	0	0	60	6	
Feb. 31– 1	0	0.2	2	25	26	5	249	126	300	0	0.5	30	0	0	20	6	40
1– 2	0	0.0	0	25	27	8	280	126	300	0	0.5	30	0	0	40	6	20
1917 Feb. 16	..	Trace	0														

Fasting.—Fasting is never so rigorous as doctors or patients expect. Patients are more ready to undergo it than physicians to prescribe it. Quite as often it is as much a relief to the patient as it is discomfort. This is in part due to the gradual decrease in thirst and frequent urination. Headache occurs less frequently than would be expected, and is usually dispelled by a cup of coffee. Nausea almost never occurs unless a patient is given alkali or alcohol. Children bear

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fasting more easily than adults. Case No. 799 with onset at eighty-three, shunned it and rightly, but she became sugar-free and now, two years later, is vigorous, remains sugar-free and is actually able to eat apple pie and put sugar in her coffee without sugar occurring in the urine. It is always desirable to avoid fasting in the old, and this can be accomplished usually by the help of preparatory treatment. Fasting does not seem like fasting to the patients when they receive coffee, tea, cracked cocoa, cocoa shells and broths, and are given an unlimited supply of water. Warm drinks are preferable. If the quantity of urine, as it often does, falls to less than normal, the patients are urged to drink water freely. Clear meat broths are a great satisfaction. An analysis of the 1220 c.c. of broths taken by Case No. 765 during three days, showed the total amount of calories therein contained to be negligible. Contrary to my experience with digestive cases, broths do not stimulate the appetite in fasting diabetics; they relieve it. The advantage of broths is probably due in part to this, but to a considerable extent to the patient receiving salt by which he may maintain the equilibrium of body fluid.

Patients need not be kept abed during fasting, neither should they be forced to be up all day. Reclining in a steamer chair requires no more exertion than rest in bed. Remember what happens to an old man who is suddenly confined to bed, and the discomfort which follows confinement after a fracture. Do not force a temperate man to drink against his will. Patients should be afforded diversion by brief visits from friends, walking short distances, easy handiwork, playing games, letter writing, and reading. In general, they are glad to rest for the greater part of the first day of the fast, but upon each succeeding day I have noticed that they are desirous to increase the amount of exercise. An advantage which the omission of fat from the diet affords is the rest which is given to the digestive tract. Former treatment, which increased the fat in the diet, was the converse of this, and frequently led to vomiting, with the result that patients on the verge of coma fell into it. In every way seek to prevent worry on the patient's part, and

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from the start give them to understand that they are at school rather than at hospital.

Patients upon a low diet should be guarded from infections. If a nurse has a cold she should be relieved from duty, certainly from duty near diabetics. For this reason, when on a low diet, patients should keep out of street cars and shun congregations of people.

It is surprising how variable is the period required to render the urine sugar-free. Frequently a urine which contains 7 per cent. of sugar becomes free from sugar after fasting for four meals, and, conversely, a urine with only 3 per cent. of sugar may still retain traces after the patient has been deprived of food for three or four days. Cases presenting acidosis I believe invariably require longer to become free from sugar. In general, cases seen soon after onset become sugar-free promptly, whereas the reverse is true for those of long duration. However, Case No. 733, age at onset seventeen years, was fasted twenty-six months later, when he showed 6.6 per cent. of sugar and became sugar-free in two days. The explanation in this instance was apparently the fact that the case was remarkably mild, being of the obesity type; in fact, the patient's highest weight—196 pounds—was reached when he first came under observation, and during the preceding twenty-six months he had gained twenty-six pounds. Children showing large amounts of sugar have also become sugar-free very promptly when the duration has been only a few weeks. Cases of long standing appear to become sugar-free more quickly with preparatory treatment than with an immediate fast. This is probably due to the avoidance of acidosis. Rarely is it necessary for a patient to fast more than a few days, and I usually prefer, after four days of fasting, if the urine still contains sugar, to feed the patient for two days and then fast again. The general rule which I have as a guide is as follows:

INTERMITTENT FASTING.—*If glycosuria persists at the end of four days, give 1 gram protein or 0.5 gram carbohydrate per kilogram body weight for two days and then fast again for three days unless earlier sugar-free. If glycosuria remains, repeat and then fast for one or two days as necessary. If there is still*

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sugar, give protein as before for four days, then fast one, and then gradually increase the periods of feeding, one day each time, until fasting one day each week. I have seen no uncomplicated case fail to get sugar-free by this method.

CARBOHYDRATE TOLERANCE.—Inspection of the various charts above cited will show that when the twenty-four-hour quantity of urine has been free from sugar it is the custom to increase the carbohydrate, and this is usually done to the point at which sugar returns. In this way the tolerance of the patient for carbohydrate is determined. My rule is: *When the twenty-four-hour urine is free from sugar, give 5 to 10 grams carbohydrate (150 to 300 grams of 5 per cent. vegetables) and continue to add 5 to 10 grams carbohydrate daily up to 50 grams or more until sugar appears.* The carbohydrate is generally given in the form of 5 per cent. vegetables, choosing those which are especially bulky. A plateful of lettuce appeals much more to the patient than a small saucer of string beans. When a mixture of 5 per cent. vegetables is given, one can be quite sure that the average content of carbohydrate is not more than 3 per cent., or approximately 5 grams for the 150 grams prescribed, and for convenience this is reckoned as 1 gram of carbohydrate for each 30 grams (1 ounce). This small amount of food, of course, has little nutritive value, but is enough to break the fast. Upon succeeding days, 5, 10 or even more grams of carbohydrate, varying with the severity of the case, are added daily until sugar returns or the approximate quantity is reached which it appears probable the patient will tolerate. It should be borne in mind that a patient fasting or on a very low diet often shows an apparent tolerance for carbohydrate far in excess of that which he would have shown if the necessary protein and fat in his diet were simultaneously ingested.

Following the trial with 5 per cent. vegetables, one can proceed to the 10 per cent. group and these can be empirically reckoned as containing 6 per cent. carbohydrate or approximately twice that of the 5 per cent. group, or 5 grams carbohydrate for 75 grams vegetables. From this point onward the addition of carbohydrate can be made according to the desire of the patient. The foods commonly employed

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in determining the tolerance for carbohydrate are: 5 per cent. vegetables, oranges, oatmeal and potato. With children one often makes the mistake of increasing the carbohydrate too rapidly, forgetting the fact that 5 grams of carbohydrate to a child weighing 20 kilograms is in the same proportion as 15 grams of carbohydrate to an individual of 60 kilograms.

The increase in carbohydrate is also illustrated by Case No. 1209, Table 27, whose chart, however, shows how sugar sometimes appears in the urine when if the doctor's advice had been followed it would have remained absent. This little boy ate candy, and though the quantity of sugar in his urine had fallen to 1 gram on January 3–4, it required two days of fasting following his use of candy for it to disappear. Once again he broke rules and fasting was necessary. Gradually he learned his lesson, at least temporarily, and left the hospital with a tolerance for 37 grams of carbohydrate and 50 calories per kilogram body weight.

PROTEIN TOLERANCE.—*When the urine has been sugar-free for three days, add about 20 grams protein and thereafter 15 grams protein daily in the form of egg-white, fish or lean meat (chicken) until the patient is receiving 1 gram protein per kilogram body weight or less if the carbohydrate tolerance is zero.*

Thirty grams of fish or an egg of average size contain approximately 6 grams of protein and 30 grams of lean meat contain approximately 8 grams. The white of an egg contains 3 grams of protein. By this arrangement a patient weighing 60 kilograms would be taking, within six days from the time he became sugar-free, 1 gram of protein per kilogram body weight. This quantity is quite satisfying to all except children—in fact, it is astonishing to me to find how few patients care to take as much as 1.5 grams of protein per kilogram body weight. Children, however, crave and need considerably more, and indeed take with avidity as much as 2 to 3 grams protein per kilogram body weight.

Fish is especially desirable in the early days of protein feeding because it contains so little fat. Cod, haddock and flounder, for example, contain less than 1 per cent.

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TABLE 27.—CHART OF A CHILD, CASE NO. 1209, AGED EIGHT YEARS AND SIX MONTHS, SHOWING HOW HE CONQUERED HIS TENDENCY TO EAT CANDY.

Date, 1917.	Urine.			Diet in grams.					Naked weight, lbs.	Dietary prescriptions in grams.									
	Diacetic acid.	Sugar.		Carbohydrate.	Protein.	Fat.	Alcohol.	Calories.		Vegetable 5 per cent.	Oatmeal.	Fish.	Chicken.	Meat.	Egg.	Sugar-free milk, c.c.	Bacon.	Butter.	Cream 40 per cent., c.c.	Vegetable 10 per cent.
		Per cent.	Total grams.																	
Jan. 1	0	9.0							56											
1– 2	0	4.0	12																	
2– 3	+	0.6	3	10	3	1	0	61	54	0	14									
3– 4	Tr.	0.1	1	10	2	0	0	48	..	300	0									
4– 5	0	3.1	31[1]	10	23	0	0	132	52	300	0	90								
5– 6	0	0.3	1	0	0	0	0	0	..	...	0	0								
6– 7	0	0	0	0	0	0	0	0	..	0	0	0								
7– 8	0	0.2	11	10	13	3	0	119	..	300	0	0	30							
8– 9	0	0	0	0	0	0	0	0	52	0	0	0	0							
9–10	0	0	0	10	17	12	0	216	..	300	0	0	0	0	1	90				
10–11	0	1.7	13[1]	15	26	18	0	326	..	450	0	0	0	0	2	90				
11–12	0	0	0	0	0	0	0	0	..	0	0	0	0	0	0	0				
12–13	0	0	0	15	26	18	0	326	54	450	0	0	0	0	2	90				
16–17	0	0	0	20	50	52	0	748	..	600	0	0	0	60	2	100	30	10		
17–18	0	0.1	0	20	59	67	0	919	..	600	0	0	0	90	2	120	30	20		
18–19	0	0	0	10	43	47	0	635	53	300	0	0	0	90	1	80	15	15		
22–27	0	0	0	31	67	92	0	1220	..	900	0	0	0	60	4	90	30	30	30	
27–28	0	0	0	37	63	98	0	1282	55	750	0	0	0	60	4	0	30	30	60	150

[1] Result of eating candy.

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The advantage of giving and increasing protein simultaneously with the determination of the carbohydrate tolerance is that one approaches more nearly normal conditions. What the physician is after is to determine the carbohydrate tolerance while the patient is on a full diet and not the tolerance for carbohydrate alone. On the other hand, I freely admit that a higher carbohydrate tolerance can be attained when the addition of protein following the preliminary fasting is deferred until the actual carbohydrate tolerance is learned in the absence of protein and fat. Naturally the method adopted will vary somewhat with each patient.

There are very few patients who will not bear at the outset as much as 1 gram of protein per kilogram body weight, and I am very loath to allow the protein to remain permanently below this figure. This can be avoided by still further restricting the carbohydrate, either temporarily or permanently. It is always necessary to remember that one food which the diabetic patient cannot do without is protein, and to it everything else must be subordinated. More and more I believe we shall strive to spare body protein.

Fat Tolerance. — The work of Professor Bloor and Dr. Gray in Boston and that of workers at various other laboratories has provided us with a reliable indicator for the tolerance of the patient for fat by means of the estimation of fat in the blood. As yet the test is too complicated for general use, but for those who have access to a laboratory it is perfectly practical. For those not in a position to employ Bloor's fat method there are two indirect methods of determining fat tolerance, namely, signs of acidosis and the appearance of sugar in the urine (glycosuria). So long as these exist the fat must be kept low. While testing the protein tolerance a small quantity of fat is included if, in addition to whites of eggs and lean fish, meat is given. Formerly I thought this advantageous, and such small quantities of fat certainly do no harm in the milder cases. In fact the same rule holds for the testing of the carbohydrate and protein tolerance in the presence of fat as has been said for protein alone. There are, on the other hand, two important reasons why fat should not be given to the diabetic

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patient immediately upon his becoming sugar-free: (1) by the omission of fat, partial fasting is continued and thereby the patient is gaining a tolerance for carbohydrate, and (2) the continued omission of fat is beneficial in counteracting the last vestige of acid poisoning, or preventing the appearance of acid poisoning, which might easily occur in a diabetic patient whose metabolism has not become accustomed to so low a quantity of carbohydrate. But as soon as the patient has received the essential gram of protein per kilogram body weight the fat in the diet should be increased. If the patient is one in whom acidosis has been an essential factor, or if the patient is obese, the fat should be increased slowly, and for such a patient an increase of 5 to 10 grams a day may be all that he can take without the recurrence of a positive ferric chloride reaction in the urine. Cases which have shown little acidosis may easily be allowed an increase of 25 grams fat daily, and for such cases this is desirable, because it rapidly brings the total caloric value of the diet up to a normal figure. Naturally, patients in whose treatment a loss of weight is desired would be given smaller quantities of fat.

The rule which I have for myself is as follows:

Add no fat until the protein reaches 1 gram per kilogram body weight (unless the protein tolerance is below this figure) and the carbohydrate tolerance has been determined, but then add 5 to 25 grams daily, according to previous acidosis until the patient ceases to lose weight or receives in the total diet about 30 calories per kilogram body weight.

REAPPEARANCE OF SUGAR.—*The return of sugar demands fasting for twenty-four hours or until sugar-free. Resume the former diet gradually, adding fat last in order to maintain as high a carbohydrate tolerance as possible, sacrificing body weight for this purpose. This rule should be inflexibly followed, especially with children.*

In hospitals it simplifies the treatment enormously. As soon as it is understood that the reappearance of sugar means a fast until sugar disappears from the twenty-four-hour quantity of urine there is little tendency to break over the diet. Furthermore, most patients are thrifty enough

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to see the disadvantage of paying their board with no return. The rule must be rigidly enforced with children, because with them disobedience means death. When a patient has been made sugar-free by a preliminary fast, absence of food for twenty-four hours will almost invariably be sufficient to free the urine at once if the sugar returns. This will not be the case unless the presence of glucose is promptly detected, and hence the necessity for the patient to examine his twenty-four-hour urine daily. Following this accessory fasting day, the previous diet of the patient may be gradually resumed, making every endeavor to regain the former tolerance for carbohydrate by slowly increasing the quantity of fat. Great care should be exercised, more indeed than I have often taken, not to break down the tolerance a second time.

Months rather than weeks should intervene before the final amounts of carbohydrate, protein and fat, reached the second time, equal the quantity of carbohydrate taken when sugar reappeared. I have always been much impressed by the success of Drs. Janeway and Mosenthal in the treatment of one of their patients, because the patient had been taught to keep the carbohydrate so low that sugar did not reappear though he was away from their supervision for a period of months.

Patients often get into trouble by their failure to energetically grapple with the reappearance of sugar. One day of fasting will accomplish far more than many days of a moderately low diet. It is a mistake for any, save the most highly trained patients, to attempt to meet such a situation without medical advice.

Case No. 804, described on page 80 illustrates this well, for it is perfectly evident that he was an intelligent patient, and yet grew steadily worse until he returned for the second period of treatment at the hospital.

Another instance is Case No. 1279, who reached a tolerance in April, 1917, at the hospital, for 78 grams carbohydrate, 63 grams protein and 109 grams fat, with a blood sugar at this time of 0.12 per cent. In the autumn of the same year sugar repeatedly recurred, and he was unable to become sugar-free at home. After a stay of a few weeks at the hos-

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pital he was discharged with a tolerance for 65 grams carbohydrate, 74 grams protein, 98 grams fat and blood sugar of 0.14 per cent.

Still another patient, Case No. 1265, shows the improvement of medical supervision. This patient, a woman, aged fifty-seven years, left the Corey Hill Hospital on May 5, 1917, with a tolerance for 30 grams carbohydrate, 58 grams protein and 119 grams fat, and a blood sugar under 0.1 per cent. Until the summer she did well, but in the early autumn apparently finding the urine normal, steadily increased her diet, yet her condition was not satisfactory to herself or her friends. Upon the return of her doctor he discovered that the Benedict solution she had been using was inaccurately made up and for over a month sugar had undoubtedly been present in the urine. Under hospital treatment she was discharged in two weeks with a tolerance for 33 grams carbohydrate, 61 grams protein and 81 grams fat, with a blood sugar of 0.14 per cent.

WEEKLY FAST DAYS.—*Whether sugar reappears in the urine or not it is desirable upon one day each week to rest that function of the body which controls the assimilation of sugar by either a complete fast day or a diet of low caloric value. My plan is patterned on the following rule: Whenever the tolerance is less than 20 grams carbohydrate, fasting should be practised one day in seven; when the tolerance is over 20 grams carbohydrate, cut the diet in half on one day each week* ("*half-day*").

This is a revival of an old practice used, I understand, many years ago by Dr. Austin Flint, of New York, who fasted and kept abed his diabetic patients on Sundays, and in fact I believe von Noorden terms such weekly fast days "Diabetic Sundays."

The benefit which the older clinicians derived from the use of one day's fast in seven in the treatment of their diabetic patients should ever be borne in mind. Case No. 1062, now under observation, who contracted diabetes twenty-six years ago, possibly in connection with gallstones, tells me that at that period her physician, Dr. Randall, of Topsfield, Mass., often told her to go without food, save broths, for several days in succession, and that

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she would follow this advice. Her severe symptoms of diabetes subsided at the end of four years. Recently the quantity of sugar has been slight. Her tolerance on June 1, 1916, reached 116 grams carbohydrate. The advantage of this restricted diet day each week is partly inherent in the fast or restricted diet, but to a considerable extent it is due to the attention of the patient being sharply called to his disease one day in seven, and the recollection which it awakens in his mind of his condition before treatment began and the difficulties which may have originally accompanied becoming sugar-free. Some exceptions to the above rules may be mentioned: for example, elderly patients bear fasting poorly, and when they remain sugar-free upon a rigid diet containing only 10 grams of carbohydrate it is my impression that it is better to simply restrict the calories of the diet one-half on one day each week rather than to institute an absolute fast. With such treatment these patients almost invariably gain in tolerance for carbohydrate. Children become fretful upon a fast day, though physically they endure it well. If they are allowed a few green vegetables in addition to broths they get along very comfortably. Von Noorden pointed out that the good effects of a fast day continued many days beyond the actual fast.

The Caloric Needs of the Patient.—The total number of calories which a diabetic requires varies not only with each case, but varies with each case each day. Schematic rules do not hold. One must remember that an individual trained to be quiet and while lying down can get along with only 20 calories per kilogram body weight reckoned per twenty-four hours, whereas the average of a large group of normal men and women at the Nutrition Laboratory, not especially trained for the test, consumed 25 calories per kilogram body weight reckoned also per twenty-four hours. If this variation exists while at rest, how much more it must exist during the various activities of different individuals. Furthermore, one must remember that the number of calories consumed per hour varies enormously. An individual weighing 60 kilos walking at the rate of four miles per hour would require an additional 193 calories for that hour over the resting

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metabolism. Habits of individuals vary widely. Some are quiet and some are active. All these considerations should be clearly borne in mind by doctors and patients in order not to allow themselves to be held too rigidly by any caloric fetish.

Special Dietetic Rules and Hints.—The responsibility for the management of the diet of a diabetic patient should always rest upon one individual. As a rule that individual is the patient, but at times another member of the household. Children who are above the age of ten years should be taught to plan their own diet. They readily learn to do this and in so doing make their elders blush. In fact, it is more important for diabetic children to learn what and how much to eat than all the knowledge which their schools afford, for upon this information their life depends. Perhaps it is because this personal responsibility is so deeply felt in the management of little children that the treatment of diabetes in them proceeds so uniformly and always produces results so much better than are expected. Eat too little rather than too much. With a return to normal weight sugar may appear.

All food must be eaten slowly, and the coarser the food the more thoroughly it should be masticated.

If in doubt about a food, let it alone until you have found out whether it is allowed. Do not yield to the temptation of friends to break the diet, for if this is done the plan of treatment is upset, a week's time may be lost and several pounds of weight sacrificed. So-called diabetic foods often contain considerable quantities of carbohydrate, and usually contain so much protein and fat that they should not be taken by the patient without due allowance for the same. They should not be taken under any circumstances unless their composition is known. Be especially careful to note the effect of any increase in carbohydrate. The same rules hold for protein. The quantity of fat is generally regulated by the patient's weight.

The carbohydrate in the diet should be divided between the three meals. Even if the 10 per cent., 15 per cent. and 20 per cent. vegetables are allowed, vegetables from the 5

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per cent. group should be taken as well. Usually it is allowable to substitute for a given quantity of 5 per cent. vegetables one-half as much from the 10 per cent. group, one-quarter as much from the 15 per cent., or one-sixth as much from the 20 per cent. Exchange vegetables for fruit only under advice. Remember it is always possible to get articles of food which are included in a strict diabetic diet for a few meals, such as eggs, meat, butter, oil and even 5 per cent. vegetables, fresh or canned. One of my cases who has done exceptionally well has a diabetic garden and thus provides liberally for his table both summer and winter. Quiet outdoor work agrees with diabetic patients.

In case of illness curtail the fat in the diet, and if acid poisoning is shown by the ferric chloride reaction, omit fat entirely.

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CHAPTER IV.

ACID INTOXICATION—ACIDOSIS—DIABETIC COMA.

Acid intoxication is the bugbear of doctor and patient. Formerly more than six of every ten diabetic patients succumbed to it, but now it is much less frequent. The acid intoxication (acid poisoning, or technically termed acidosis) of diabetic patients differs in no respect from the acidosis of normal individuals, easily to be produced within three days by the omission of carbohydrate from the diet. The ferric chloride (diacetic acid) reaction will then appear just as in a severe diabetic, and if at the same time the quantity of fat is increased, a type of acidosis will be caused, so severe as to threaten the life of the individual. When, however, the healthy body is gradually accustomed to live upon a diet low in carbohydrate, acidosis is avoided. The same course of events takes place in diabetes. In severe cases when all the carbohydrate of the diet appears in the urine as sugar, the diabetic patient, although eating carbohydrate, is exactly like the normal individual deprived of his customary carbohydrate. If fat in undue quantities is given to a severe case of diabetes, under these circumstances diabetic coma may result. This did result when years ago we physicians, doing the best we knew, deprived patients of their carbohydrates in order to make them sugar-free, and at the same time, in order to enable them to maintain their weight, we markedly increased fat and protein to make up the calories omitted as carbohydrate. From what has been already written, it can be seen that now we know better.

Patients are first of all deprived of fat, without other change in their dietary habits, in order to take away the great danger of acid intoxication, and they subsequently are

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either made sugar-free by gradual reduction of carbohydrate and protein or by simply fasting. When sugar-free and one begins to increase the diet, the fat is the food element to be given last of all.

Even when patients already showing acidosis come for treatment, it usually disappears under the above plan. Should the acidosis be severe the following rules, now in force for my cases at the New England Deaconess and Corey Hill Hospitals, are suggested. I recommend that all patients become familiar with these rules, and thus anxiety over acid poisoning will disappear. This plan of treatment seldom fails. Indeed, since I have established it as a routine method of procedure, worry about acid poisoning in my patients has largely decreased, and evening visits to the hospitals are eliminated.

RULES FOR THE TREATMENT OF SEVERE ACID POISONING.

1. *Nursing.*—Provide a special nurse for the patient for both day and night, and preferably one trained in diabetic work.

2. *Bed.*—Keep the patient in bed and warm. Avoid loss of calories through exertion or exposure; if restless, protect from becoming chilled by flannel nightclothes. Every effort should be made to allay nervousness and discomfort.

3. *Care of the Bowels.*—Move the bowels by one or more enemata. Cathartics should usually be avoided for fear of causing diarrhea.

4. *Administration of Liquids.*—Give 1000 c.c. (1 quart) of liquids within each six hours. The liquids are to be given slowly, and hot. Use coffee, tea, thin broths, water; see also 5. If the prospect is dubious of giving so much liquid by mouth, salt solution or tap water is to be given by rectum; if this resource fails, the nurse should call the doctor to give intravenously, or if that is impossible, subcutaneously, the balance of the liter which remains not given for the period. (It will seldom be found necessary to give more than 1000 c.c. liquids, thanks to the avoidance of alkalis.) In order to secure the introduction of sufficient liquid in the first six

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hours, the cleansing enema at the beginning of treatment should be followed after half an hour by an enema of 500 c.c. salt solution (one teaspoonful salt in one pint of water) in all cases as a matter of precaution.

5. *Diet.*—If the patient has been accustomed to the fasting method of treatment, begin or continue the fast, but if he has been upon a full diet omit the fat which it contained, but continue the same quantity carbohydrate and protein of the preceding days, giving at least a gram of carbohydrate per kilogram body weight in the form of strained orange juice or gruel (oatmeal) made with water, during the twenty-four hours. Of late I have given each six hours an amount of carbohydrate equal to or slightly in excess of that voided in the urine during the preceding twenty-four hours. Whichever course is adopted, it is to be followed until danger is over. The carbohydrate should be given in a form easily tolerated by the stomach, such as carefully made gruels, orange juice, skimmed milk or bread. Avoid an excess of coarse vegetables.

6. *Stomach.*—If there is evidence of retained food in the stomach or of a dilated stomach, the stomach should be emptied at once. The prompt recognition of such a state and its relief I believe will save many lives. With adults when in doubt, but with children in all cases, begin treatment with gastric lavage.

7. *Heart.*—Sustain the circulation with the help of digitalis. Caffein may be given subcutaneously or as black coffee by the rectum.

8. *Alkalis.*—Avoid alkalis. If such have been previously given, omit at the rate of 30 grams a day.

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CHAPTER V.

WEIGHT PECULIARITIES.

Most diabetic patients are obese prior to the onset of diabetes. As soon, however, as sugar begins to be lost in the urine, the weight usually falls because too little food is eaten to make up for that lost. It is not uncommon for a patient to lose 50 pounds before treatment begins, and occasionally a patient will lose as much as 100 pounds during the course of years. A diabetic patient in reality is probably in safer condition if he is 10 to 20 per cent. below weight, because thus he can be assured that he is not overeating. In this respect it is better to emulate the Indian than the Eskimo. The individual 10 per cent. and even 20 per cent. below weight may not be a delight to our eyes, but if over thirty-five years of age and in this condition he is much more acceptable to the Insurance Company. It is often desirable for a patient to lose weight, but this should be undertaken only under

Table 28.—The Weight of Normal Individuals.[1]

Height.			Age 15 to 24.		Age 25 to 29.		Age 30 to 39.		Age 40 and over.	
Ft.	In.	Cm.	Lbs.	Kg.	Lbs.	Kg.	Lbs.	Kg.	Lbs.	Kg.
5	0	152.4	120	54.5	125	56.7	129	58.5	133	60.4
5	1	154.9	122	55.4	126	57.2	130	59.0	135	61.3
5	2	157.5	124	55.8	128	58.1	132	59.9	138	62.6
5	3	160.0	127	57.6	131	59.5	135	61.3	141	64.0
5	4	162.6	131	59.5	135	61.3	139	63.1	144	65.4
5	5	165.1	134	60.8	138	62.6	142	64.4	148	67.2
5	6	167.7	138	62.6	142	64.4	146	66.3	152	69.0
5	7	170.2	142	64.4	147	66.7	151	68.5	156	70.8
5	8	172.7	146	66.3	151	68.5	155	70.3	161	73.1
5	9	175.3	150	68.1	155	70.3	160	72.8	166	75.3
5	10	177.8	154	69.9	159	72.2	165	74.9	171	77.6
5	11	180.3	159	72.2	164	74.4	171	77.6	177	80.3
6	0	182.9	165	74.9	170	77.1	177	80.3	183	83.0
6	1	185.4	170	77.1	177	80.3	183	83.0	190	86.2
6	2	188.0	176	79.9	184	83.5	190	86.2	196	88.9
6	3	190.5	181	82.1	190	86.2	197	89.4	201	91.2

[1] Average for men and women with clothes. Clothes weigh 8 to 10 pounds, or about 4 kilograms.

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TABLE 29.—HEIGHTS AND WEIGHTS OF CHILDREN.

Age.	Height.				Weight.			
	Boys.		Girls.		Boys.		Girls.	
	Inches.	Cm.	Inches.	Cm.	Pounds.	Kg.	Pounds.	Kg.
Birth[1]	20.6	52.5	20.5	52.2	7.55	3.43	7.16	3.26
1 year	29.0	73.8	28.7	73.2	21.0	9.54	20.5	9.31
2 years	32.5	82.8	32.5	82.8	27.0	12.27	26.0	11.81
3 years	35.0	89.1	35.0	89.1	32.0	14.55	31.0	14.09
4 years	38.0	96.7	38.0	96.7	36.0	16.36	35.0	15.90
The heights and weights in the above table are net, *i. e.*, without shoes or clothes.								
Age at last birthday.								
5 years	41.7	105.9	41.3	104.9	41.0	18.6	39.6	18.0
6 years	43.9	111.5	43.3	110.1	45.2	20.5	43.4	19.7
7 years	46.0	116.8	45.7	116.0	49.5	22.5	47.7	21.7
8 years	48.8	123.9	47.7	121.1	54.5	24.7	52.5	23.8
9 years	50.0	127.0	49.7	126.2	59.6	27.0	57.4	26.0
10 years	51.9	131.8	51.7	131.3	65.4	29.5	62.9	28.5
11 years	53.6	136.1	53.8	136.6	70.7	32.1	69.5	31.5
12 years	55.4	140.7	56.1	142.4	76.9	34.9	78.7	35.7
13 years	57.5	146.0	58.5	148.5	84.8	38.5	88.7	40.3
14 years	60.0	152.4	60.4	153.4	95.2	43.2	98.3	44.6
15 years	62.9	159.7	61.6	156.4	107.4	48.8	106.7	48.5
16 years	64.9	164.8	62.2	157.9	121.0	55.0	112.3	51.0

The heights in the above table are without shoes.

The weights are with indoor clothes. These make up for boys approximately 8 per cent., and for girls 7 per cent., of the gross weight.

The term, "age at last birthday," is liable to give a wrong impression, because the figures given are really average figures taken from all the children from that birthday to the next. A more accurate term is the succeeding half-year; age approximately for succeeding half-year; *i. e.*, five and a half years instead of five years, the age at the last birthday.

the doctor's direction. Frequently it is only by losing weight that a patient regains the power to tolerate carbohydrate, but as yet I have not reached the point of purposely beginning treatment by reducing the weight of a diabetic to below normal, though perhaps this would be the best way. As a guide to the proper weight for a diabetic, the average weights of individuals for given heights and weights when dressed, according to Shepherd's statistics, are given in Table 28. Along with these I include weights for normal children selected by Dr. John Lovett Morse, Table 29.

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Changes in Weight during Treatment.—Diabetic patients are often surprised at the sudden change in weight which they undergo during a two weeks' course of treatment. Occasionally the weight goes up, but more often it falls. It may remain the same or even increase during several days of fasting. The reason for these changes is to be explained by the retention or discharge of water from the tissues. The following experiment conducted by me many years ago illustrates this well. A student was given a diet sufficient to maintain his body weight so far as nutritive value was concerned, but from his food salt was entirely removed. As a result, in the course of thirteen days the weight fell 11.66 pounds. Upon the resumption of his former diet with salt as desired, 9 pounds of those lost were regained in three days. Diabetic patients often gain weight from exactly the same cause—namely, the ingestion of too much salt. Such gain in weight, however, should be looked upon at its real value, in other words, simply as a retention of fluid in the body.

Case No. 1378, showing considerable dropsy, lost weight as shown in Table 30. When the equivalent of the weight lost was weighed out in water it half-filled a pail, and when we realized that this had been carried about all day in the tissues of the patient, all of us were far more sympathetic toward the patient's disinclination to go up and down stairs.

Soon after entrance the salt in the diet was partially restricted, but evidently not enough to prevent increase in weight, as the chart shows (see September 23–24). From

TABLE 30.—CHART OF CASE NO. 1378. ILLUSTRATION OF DISAPPEARANCE OF DROPSY COEXISTENT WITH LOSS OF WEIGHT DUE TO A SALT-FREE DIET.

Date, 1917.	Urine.			Diet in grams.					Weight, lbs.
	Diacetic acid.	NaCl, grams.	Sugar Total grams	Carbohydrate	Protein.	Fat.	Alcohol.	Calories.	
Sept. 13–14	0	—	0	3	20	6	....	146	89¼
23–24	0	4.9	6	17	50	42	50	996	98¾
Oct. 21–22	0	..	0	12	53	52	30	938	69½

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this point onward the salt was excluded with the greatest care from the diet, and the weight uniformly fell. It is noteworthy that this patient a year previously, some thousands of miles from Boston, had been given during a period of six months enemata of 8 quarts of salt and soda daily. Furthermore, she was then in the habit of taking beef tea loaded with salt, and each week consumed one and a half pounds of salted almonds, as well as using salt freely in her food.

It is also interesting that although the carbohydrate in an individual's diet is replaced by an equivalent number of calories in the form of fat, the weight promptly falls, and if the reverse procedure is adopted the weight will rise. The loss or gain of weight which occurs under such conditions may amount to 2 pounds in a day for several days. Finally, there is a real reason for a loss of weight during the treatment of diabetes, due to the fact that the diet is often deficient in calories. Against this loss we must fight!

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CHAPTER VI.

THE DIET OF THE UNTREATED DIABETIC IS EXPENSIVE.

CASE No. 1171, before treatment was begun, told me that he ate 13 eggs for breakfast, not by any means as a stunt, but because he wanted them. Case No. 1147, a lady of thirty-five years of age, ate a dozen eggs a day, and in response to my request gave me a report of her daily diet before she began treatment. This is shown in Table 31. It will be observed, however, that the carbohydrate was below normal—good evidence, therefore, that her diet had already been somewhat altered from the normal before the time at which she reported; in fact, I think her diet was originally considerably in excess of that recorded.

TABLE 31.—ESTIMATED DIET OF A WOMAN OF THIRTY-FIVE YEARS, CASE NO. 1147, PRIOR TO TREATMENT. WEIGHT SEVENTY-TWO KILOGRAMS.

Food for twenty-four hours.	Quantity.	Carbohydrate, grams.	Protein, grams.	Fat, grams.
Eggs	12	0	72	72
Five per cent. vegetables	450 grams.	15	8	0
Milk	2000 c.c.	96	64	64
Forty per cent. cream	240 c.c.	8	8	96
Butter	90 grams.	0	0	75
Meat	120 grams.	0	32	20
Bread	100 grams.	60	10	0
	Totals	179	194	327
		4	4	9
	Total calories	716	776	2943

Total calories 4435 ÷ 72 kilograms = approximately 60 calories per kilogram body weight.

Although the diet contained 60 calories per kilogram body weight instead of the normal 30 calories the patient, while

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upon it, lost 66 pounds in a little over two and a half years. The reason for this was apparent, for on October 6, 1916, the volume of the urine was estimated at 6000 c.c. (6 quarts) and the sugar was found to be 5 per cent. or 300 grams

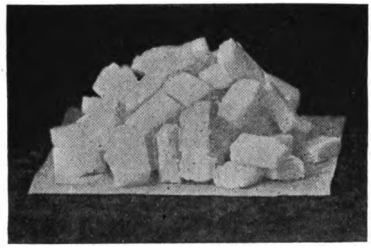

FIG. 14.—The quantity of sugar daily lost in the urine by a moderate diabetic, Case No. 1147. (See also frontispiece)

(10 ounces), the equivalent of a loss of 1200 calories in the urine in twenty-four hours. In one year this would amount to 240 pounds of sugar! After a two weeks' stay in the hospital she felt more content with a diet of 1600 calories—a trifle less than her body needs—than when upon that at entrance.

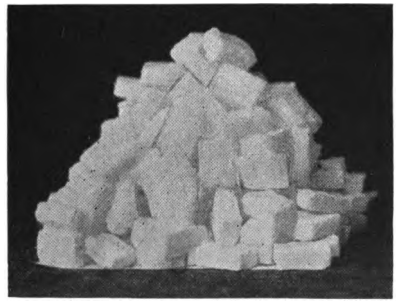

FIG. 15.—The quantity of sugar daily lost in the urine by a severe diabetic, Case No. 295. (See also frontispiece.)

It is obvious that the saving of food which results from becoming sugar-free under modern treatment must be considerable. It is the diet of the untreated diabetic which is expensive, since the large excess is far worse than wasted.

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Case No. 295 voided in twenty-four hours on October 23–24, 1909, approximately 10 liters of urine (nearly 20 pounds) containing 680 grams of sugar, the equivalent of 2720 calories! The weight of this patient was 50 kilos. In other words, he lost in the urine 54 calories per kilo, an amount sufficient in calories to supply almost double his own needs if taken in the form of food which he could assimilate.

Diabetic patients with acid poisoning lose calories in the urine not only in the form of sugar but as acid bodies as well. The quantity of acid bodies thus lost is quite considerable. These acid bodies represent wasted food just as much as does the sugar in the urine. Case No. 344 is a good illustration of this. On December 25–26, 1911, he excreted 188 grams sugar, the equivalent of (188 × 4) 752 calories, and in addition 55 grams acid bodies, equivalent to (55 × 5) 275 calories. Acid intoxication is really a dreadful robber, for besides stealing the food of a patient, it frequently steals his life!

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CHAPTER VII.

CARE OF THE TEETH.

MANY diabetics have sound teeth, thus showing that diabetes is not necessarily productive of bad teeth. On the other hand, the teeth should always be kept in good condition, for it is common to have the diabetes grow worse in the presence of inflammatory conditions about the teeth and gums. The teeth should be cleaned after each meal and it is desirable to have them cleaned by a dentist at least every three months. If the teeth are to be extracted, novocain injected cautiously acts admirably. If necessary, gas or gas and oxygen may be employed, but ether should be used only when the carbohydrate tolerance is high and after careful consideration.

I consider the care of the teeth of enough importance to insert the following abstract of a dentist's leaflet, which supplies specific instruction on this subject.

CLEAN TEETH WILL NOT DECAY.

How can all the food be removed from all the surfaces of all the teeth after each meal?

1. By brushing.
2. By using floss silk between the teeth.
3. By thoroughly rinsing the mouth with lime water.

Rules for Brushing the Teeth.—1. Brush four times a day:

Before breakfast, with clear water.

After each meal, with a tooth paste or powder.

The teeth must be clean and free from food before going to bed, as most of the decay takes place while sleeping.

2. Brush two minutes each time (two minutes by the clock).

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It takes two minutes of brushing to properly stimulate the gums and thoroughly cleanse the teeth. Be sure and brush the gums.

3. Do not use pressure with the brush. A fast, light stroke is the best. A brush should never be worn out by having its bristles flattened and spread out.
4. Candies, sugar, crackers, cake, pastries, bread will all decay the teeth if allowed to remain on their surfaces.

Floss Silk.—Four-fifths of the decay of teeth takes place on the surfaces between the teeth and one-fifth on the surfaces on which one chews. There is but one way which is effective in removing the food from between the teeth, and that is with a piece of floss silk.

Use a section of floss about twelve inches long. Hold one end between the thumb and first finger of the left hand and wrap the floss twice around the end of the first finger. Do the same with the thumb and first finger of the right hand. Now by using combinations of the ends of the thumbs and second fingers the floss may be carried into the mouth and forced carefully between all the teeth. Rub it back and forth against the surfaces of each tooth to loosen and remove the food and to clean these surfaces. After a little practice one can floss all the surfaces between the teeth in a minute's time.

There still remains on the surfaces of the teeth, especially between them, a glue-like deposit known as mucin. This mucin must be removed, as it allows the bacteria to cling to these surfaces. The most effective and harmless solvent to use as a mouth wash is lime water. In fact if but one thing could be used to prevent decay of the teeth, lime water used three times daily would prove to be the most valuable.

Preparation of Lime Water.—Secure coarse, unslaked lime and crush it into a fine powder. Place a half-cupful in an empty quart bottle and fill nearly full with cold water. Thoroughly shake and then allow the lime to settle to the bottom of the bottle, which will take several hours. Avoid injury to furniture from heat generated in the bottle. After the lime has settled pour off as much of the clear water as possible without losing any of the lime, as this first mixing

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contains the washing of the lime. Again fill with cold water, shake well and allow it again to settle.

Into an empty twelve-ounce bottle pour the clear lime water, taking care not to stir up the lime in the bottom of the bottle. Again fill the quart bottle with cold water, shake thoroughly and set it aside to use when the smaller bottle becomes empty. This process may be repeated until the half-cup of lime has made five or six quarts of mouth wash.

The twelve-ounce bottle is used as it is more easily handled at the wash bowl. After brushing and flossing the teeth, pour out a little of the lime water in a glass and taking it in the mouth force it back and forth between the teeth with the tongue and cheeks until it foams. If you rinse it long enough to make it foam it has then been in the mouth long enough to have a beneficial action on the teeth. After spitting it out rinse the mouth with clear water to take away the taste of the lime. If the lime water is a little strong at first, dilute it with clear water in the small bottle, half and half. It should be used clear and full strength as soon as the gums become hard and healthy from brushing.

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CHAPTER VIII.

CARE OF THE SKIN.

THE skin must be kept unusually clean. Take a tub bath daily, but avoid prolonged cold baths. Short cold baths are often desirable. One boy I know took his cold morning bath in four seconds; adults often go to the other extreme in point of time and thus lose the good effect.

Protect the Skin from Injuries.—If any infection occurs, see a physician at once. Infections of the skin are apparently less common now than formerly and this may be attributed to cleanliness. Such infections are and should be rare in diabetic patients under treatment. They demand immediate, thorough, yet gentle, treatment. One of the first duties of the physician is to tell diabetic patients to keep the skin clean and to report the beginning of an infection at once. Patients should be warned of the danger from slight wounds, should specifically be advised not to allow manicurists or chiropodists to draw a drop of blood, and cautioned to promptly report any injury to the skin. Absolute cleanliness of the body is essential. Subcutaneous injections, whether of water, salt solution or drugs may be harmful, but with modern asepsis I hope can be safely employed. It is common for salt solution or solutions of sodium bicarbonate, when injected subpectorally, to result in abscess. If there is the slightest tendency to furunculosis, I at once adopt simple measures analogous to those described by Bowen.[1] The patient is advised to wash the whole body twice a day with soap and water, using a wash cloth or piece of flannel, and to dry the skin without rubbing, so as to avoid breaking open any pustule; the whole body is then bathed with a saturated solution of boracic acid in water, with the addition of a small

[1] Bowen: Jour. Am. Med. Assn., 1910, lv, p. 209; Boston Med. and Surg. Jour., 1917, clxxvi, p. 96.

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proportion camphor water and glycerin. I have often used a solution of two parts alcohol and one part water to advantage, but I notice that Bowen in his second paper still prefers the boracic acid. Individual furuncles may be treated with the following ointment; according to Bowen:

Boracic acid	4
Precipitated sulphur	4
Carbolated petrolatum	30

One should be careful, however, not to overtreat the skin. Harm may result from frequent dressings. The simplest lotions should always be employed. In severe cases the patient should be put to bed, all linen changed twice daily, and the patient treated in as aseptic a way as possible. In a few cases vaccines have appeared to be of marked benefit. "This procedure, thorough bathing and soaping, the application of the borated solution, and the dressing of the individual furuncles, is repeated, as has been said, morning and night. A further point of vital importance relates to the clothing that is worn next the skin. Every stitch of linen worn next to the skin should be changed daily, and in the case of extensive furunculosis all the bedclothing that touches the individual, as well as the nightclothing, should be subjected to a daily change. Naturally, this treatment must be *continued for several weeks after the last evidence of pyogenic infection has appeared,* and this fact must be emphasized to the patient at the outset." (Bowen.)

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CHAPTER IX.

TREATMENT OF CONSTIPATION.

THE bowels should move daily. The coarse vegetables and fruit of the diet may prove quite sufficient, but if necessary, bran muffins made with agar agar (see page 130) may be employed. Never purge the bowels but depend upon an enema or upon simple laxatives, such as aloin, grain $\frac{1}{5}$; fluid-extract of cascara sagrada, 10 to 30 drops; extract cascara sagrada, 5 grains, or compound rhubarb pills.

If diarrhea occurs, go to bed, keep warm and drink hot water.

If the patient has not had a movement for several days, at the beginning of treatment give an enema followed by some simple cathartic or mild aperient, and another enema twelve to twenty-four hours later; but do not purge the patient. Gain enough is obtained if a movement is produced once in twenty-four hours when it has only been taking place once in seventy-two. In other words, do not upset any patient who is in a tolerable state.

The following exercises for constipation were recommended to me by Mr. Gustaf Sundelius:

HOME EXERCISES FOR CONSTIPATION.

1. *Abdominal Kneading and Stroking.—Kneading.*—Lying down, with knees slightly drawn up. Place hands one on top of the other on the abdomen at the right groin; with small circular movements and deep pressure work upward until the ribs are met, then across toward left, following the boundary-line of the chest, then downward to the left groin. Repeat twenty to fifty times. *Stroking.* With hands similarly placed, make long, steady and deep strokes following the same route. Repeat twenty-five to one hundred times.

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2. *Leg-rolling.*—Lying down, take hold of both legs just below the knees, press the knees up close to the abdomen, then carry them apart, then down and inward until they meet again, thus letting the knees describe two circles. Repeat ten to twenty times.

3. *Abdominal Compression.*—Standing against the wall with hands clasped behind neck, draw the abdomen forcibly in, using the abdominal muscles, hold a second, then let go. Repeat ten to forty times.

4. *Trunk-rolling.*—Standing with hands on hips, feet apart and legs well stretched, roll the upper body in a circle on the hips by bending forward, to the left, backward and to the right. Then reverse, and repeat six to twelve times each way.

Case No. 559 warded off constipation by sawing wood, and Case No. 265 regulated his bowels by eating a slice of raw cabbage for breakfast.

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CHAPTER X.

DRUGS IN THE TREATMENT OF DIABETES.

DRUGS are not recommended by physicians like Professor Naunyn, the Nestor of diabetic treatment, or by those concerned in the recent advance in diabetic treatment in this country.

Drugs are not prescribed with the purpose of lowering the sugar in the urine in the most famous of our large hospitals.

On the other hand, drugs are frequently recommended, I have observed, (1) by physicians who do not determine the quantity of carbohydrate in their patients' diets or the quantity of sugar in the urine, (2) by those who are not connected with large hospitals, and (3) by those who do not have access to well-equipped laboratories.

I wish I knew of a good drug for diabetic patients. It would save me so much time and talk.

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PART III.

THE DIABETIC MENU AND FOOD VALUES.

CHAPTER I.

DIETETIC SUGGESTIONS, RECIPES AND MENUS.

THE narrow confines of the diabetic diet have greatly stimulated the manufacture of so-called diabetic foods. These are often serviceable, but are to be employed with discretion. Their use should be discouraged at the beginning of treatment. The patient should never become dependent upon special diabetic foods, for they are often unobtainable, always make him conspicuous, and when he acquires a disgust for foods of this class it is all the harder to abide by the original diet. When the patient buys one of these foods, unfortunately he is often given a list of other diabetic foods and a new diabetic diet list, and confusion in the diet often results. The patients under my care who have done best either never use special diabetic foods or only a few varieties, such as Akoll Biscuits, Barker's Gluten Flour, Casoid Flour, Hepco Flour, Lister Flour, No. 1 Proto Puffs and Sugar-free Milk.

Substitutes for Bread.—Many of the preparations upon the market contain as great or even a greater quantity of carbohydrate than ordinary bread; a few contain less; but the percentage of carbohydrate may vary from time to time. Patients, and sometimes physicians, forget that substitutes for bread must be prescribed only in definite amounts. A diabetic bread should never be prescribed without a knowledge of its content of carbohydrate, protein and fat.

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The bread of one of the largest bakeries in Boston, upon analysis, showed 55 per cent. carbohydrate. Bread made without milk or sugar, but with water and butter, contains 45 to 50 per cent. carbohydrate. Such a bread is undoubtedly superior to many different bread substitutes upon the market. The percentage of carbohydrate in toast is greater than in plain bread because it contains less water. Some of the coarser kinds of bread, such as rye bread, graham bread, black bread and pumpernickel, contain somewhat less carbohydrate. Never give bread substitutes early in treatment. Teach patients to live without them.

Bran Bread.—Bran is being more and more employed in the diet of diabetic patients. This is neither more nor less than the use of cellulose, and this is supposed to have no effect upon the metabolism. Unfortunately, the availability of the protein, fat and carbohydrate of wheat bran to the diabetic patient has not been determined, although there are plenty of data upon its digestibility by ruminant animals. Bread made of bran alone is not very palatable, though with the fat of bacon or butter it is liked better. It furnishes bulk and acts favorably upon constipation. If made with eggs and butter the flavor is improved. It should be remembered that bran often contains a considerable quantity of starch. For this reason bran biscuits often prove to be a delusion and a snare, and I dread to see them on a patient's tray. In large hospitals where diabetic patients are constantly being treated the danger is less, for the bran is bought by the same person and at the same place; but in private practice this is different. In purchasing bran go to a feed store and ask for coarse bran for cattle and not for bran for the table. The various preparations of bran, bran breads and cookies sold under trade names often contain carbohydrate other than bran, hence the reason for their palatable taste; beware of them! They may contain over 60 per cent. carbohydrate, of which less than 10 per cent. is real bran. Mild diabetics get into little trouble with bran, but the serious ones often suffer. The starch may be washed out with water by tying the bran in a cheesecloth and fastening the same on a faucet. It should be thoroughly mixed and

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kneaded from time to time to be sure the water reaches all portions, and should be washed until the water comes away *clear*. This may require an hour.[1]

Gluten Breads.—These breads are made by removing the sugar-forming material from the flour. It is surprising how thoroughly this can be done. I have often found the percentage of carbohydrate in one such flour to be negligible. The large quantity of protein in small bulk which they contain is objectionable.

Light Breads.—French bread cut in thin slices is often useful, because it is bulky, gives the appearance of a large quantity and carries much butter. Manufacturers have taken advantage of this idea, and many light breads are on the market. These breads often contain about the same quantity of carbohydrate as ordinary bread, though a few contain considerably less. Their virtue often consists solely in their bulk, which allows a surface on which to spread butter. I seldom advise breads. It is better for the patient to forget the taste.

Various other substances have been used for flour in the manufacture of bread. Thus, aleuronat meal has been employed, and with it have been mixed various vegetable products. A group of casein breads is upon the market in the form of casoid flour and Lister's Diabetic Flour, and to some diabetics these are valuable.

Soy bean is also extensively used, and probably deserves a still wider introduction into the diabetic diet. The carbohydrate in it is unassimilable. It is used in the manufacture of Hepco Flour. Agar agar may be used to dilute the flour or to add to bran and also to relieve the constipation of the diabetic, which is frequently troublesome.

Substitutes for Milk.—A few tablespoonfuls of cream are a great comfort to a diabetic patient. Except in cases with a very low tolerance a gill (120 c.c.) of 20 per cent. cream can

[1] Four preliminary analyses of washed bran showed the following percentages of starch: 0.6, 1.8, 2.7, 5.2 per cent. Two preliminary analyses showed pentosan 29.8, 33.5. The wide variations in the percentages of starch will account for the occasional occurrence of sugar in the urine following the use of bran cakes. I hope these investigations will be continued in the laboratory from which I obtained these analyses.

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generally be allowed, and if it is desirable to give more fat without increasing carbohydrate and protein, a gill of 40 per cent. cream is also well borne. Formerly patients took half a pint of 40 per cent. cream readily. With severe cases it is seldom possible to allow more than 60 to 90 c.c. of 20 per cent. cream, for the balance of the fat which can be safely employed can more advantageously be taken in meat, butter, oil and cheese. On the other hand, fat having been removed, the chief value of the milk to the diabetic patient is lost. The percentage of sugar in sour milk is not much less than in fresh milk. Recently, sugar-free milks[1] have been put upon the market on a large scale, and many of my patients, particularly children, have found them of distinct advantage. These preparations of diabetic milk will keep from one to three weeks, and are consequently of great value to patients when travelling. As a rule they are concentrated one-half. Consequently they should be diluted before being used. They are so valuable for diabetic patients that I always encourage their use in small quantities at first, so that the patient can become accustomed to the artificial taste and can determine the form in which the milk is most agreeable to him. This is often as equal parts of milk and Vichy Célestins.

Williamson[2] suggested the following rule for the manufacture of artificial milk: "To about a pint of water, placed in a large drinking pot or tall vessel, three or four tablespoonfuls of fresh cream are added and well mixed. The mixture is allowed to stand from twelve to twenty-four hours, when most of the fatty matter of the cream floats to the top; it can be skimmed off with a teaspoon easily, and upon examination it will be found practically free from sugar. This fatty matter thus separated is placed in a glass." The white of an egg is added to it and the mixture well stirred. Then dilute with water until a liquid is obtained which has the exact color and consistency of ordinary milk. "If a little salt and a trace of saccharin be added, a palatable drink, practically

[1] D. Whiting & Sons, Boston.

[2] Williamson: Diabetes Mellitus and its Treatment, Macmillan Company, 1898, p. 334.

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free from milk-sugar, is produced, which has almost the same taste as milk, and which contains a large amount of fatty material. With very little practice the right proportions can be easily guessed, and of course much larger quantities can be employed (in order to prepare a considerable amount of the drink at one time) than those mentioned above."

Rennet may be made from milk, but unless the curd is carefully washed it will contain 2 to 2.5 per cent. lactose. When the rennet is made from cream the lactose is materially diminished. Kefir contains approximately 2.4 per cent. milk-sugar. Von Noorden says this milk has also been of great help in the treatment of diabetes in children.

Lawrence Litchfield, of Pittsburgh, gives whipped cream to his patients made according to the following rule: Add two ounces of 40 per cent. cream to a pint of cold water in a Mason jar and have it shaken vigorously until the cream is thoroughly "whipped." Sometimes a trace of saccharin is added, usually not. "My patients like to eat this with a spoon, but, of course, it can be used in any way that is desired. It contains only a trace of sugar."

The fermented milks contain about half as much carbohydrate as ordinary milk.

RECIPES.

Many books have been written containing recipes for diabetic patients. With modern methods of treatment, however, most of these rules are worthless for severe diabetic patients because of their high content of protein and fat. In general such patients prefer and should be encouraged to take simple natural foods rather than artificial ones.

The mild cases of diabetes need no special recipes. Desserts can often be made with gelatin, and this may be flavored with coffee, lemon, rhubarb or cracked cocoa. In preparing such desserts if saccharin is used it should be added as late as possible during the cooking, for it is apt to become bitter with heat. It is always a safe rule to add too little rather than too much saccharin. Usually one need pay little attention to the quantity of protein in the gelatin, because

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the ordinary portion of jelly contains only about 2.5 grams. One of my patients on a very rigid diet so enjoyed the bulk of the gelatin as to take 10 grams daily. She accomplished this by having the gelatin made very thick.

DIABETIC BREAD.

1 Box Lister's Diabetic Flour[1]
3 Eggs

METHOD.—Separate whites and yokes of eggs. Add to whites salt to taste. Beat whites until very thick. Beat yolks until thick and lemon colored. Combine and beat with egg-beater. Fold in gradually one box of Lister's Diabetic Flour. Bake in tin 5 inches long, 3 inches wide and 3 inches high (straight sides). Have oven hot. If baked in gas-stove oven, bake for fifteen mnutes, full heat, then reduce heat one-half for ten minutes longer. If baked in coal or wood oven, bake from fifteen to thirty minutes. Do not open oven door until bread is done. Do not remove from tin until partly cooled. Each loaf contains protein, 58 grams; fat, 18.6 grams; calories, 397.

LISTER'S LITTLE CAKES.

1 Box Flour } Makes 150 Cakes
10 Eggs }

Each cake contains protein, 0.66 gram; fat, 0.40 gram; calories, 6.

[1] The following analysis of Lister's Diabetic Flour is given out by the manufacturers. This is used in the preparations of a number of the recipes which follow:

ANALYSIS OF LISTER'S DIABETIC FLOUR.

	Per cent.	Grams in each 2-ounce box.
Moisture	10.66	6.05
Ash	1.63	0.93
Fat	0.67	0.38
Protein	69.95	39.66
Starch	0.00	0.00
Sugar	0.00	0.00
Leavening	17.09	9.69

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METHOD.—Beat eggs until very stiff. Stir in one box of Lister's Diabetic Flour without further beating. Use flat baking pan that has been slightly greased, deposit the dough or batter in small amounts about the size of a 50-cent piece. Bake in moderately hot oven for about ten minutes.

DIABETIC NOODLES.

METHOD.—To the well-beaten yolks of two eggs, add two tablespoonfuls of warm water and a little salt. Slowly stir in one box of Lister's Diabetic Flour. Knead and roll on pie-board. When almost dry, roll and cut fine. Dry thoroughly.

DIABETIC MUFFINS.

1 Box Lister's Diabetic Flour
1 Egg
3 Tablespoonfuls of sweet heavy cream (40 per cent. cream)
2 Tablespoonfuls of bacon fat

Same quantity of butter, melted lard or Crisco may be used in place of bacon fat. This will make eight muffins, each muffin having food value equivalent to one egg (or protein, 6 grams; fat, 6 grams; calories, 78).

METHOD.—Beat white of egg very stiff; beat yolk separately from white; to the beaten yolk add the cream and beat; then add bacon fat (butter, melted lard, or melted Crisco); beat again, then add the beaten white of egg; lastly the flour, beating the mixture all the while the flour is slowly added. Put in buttered, hot muffin irons and bake for ten to twenty minutes. If coal range is used, bake for fifteen minutes and have the oven hot. Oven door should not be opened for ten minutes. Use old-fashioned cast-iron muffin iron.

LISTER'S FLOUR AND BRAN MUFFINS USEFUL IN DIABETIC CONSTIPATION.

1 Level tablespoonful lard, bacon fat, butter or crisco
1 Egg
2 Tablespoonfuls heavy cream
1 Cupful washed bran
1 Package Lister's Flour
½ Cupful water or less

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Tie dry bran in cheesecloth and soak one hour. Wash by squeezing water through and through. Change water several times; wring dry. Separate egg and beat thoroughly. Add to the egg yolk the melted lard, cream and beaten egg white. Add Lister's Flour, washed bran and water. Make nine muffins.

DIABETIC COOKIES.

1 Box Lister's Diabetic Flour
1 Egg
3 Tablespoonfuls of cream
3 Tablespoonfuls of butter or bacon fat

METHOD.—Beat egg until light. Add cream and beat again. Add butter and beat again. Then add Lister's Flour slowly. A little caraway seed, ginger or vanilla may be added to suit the taste. Roll very thin and only a small amount at a time. Bake in hot oven about ten minutes.

Makes thirty cookies of about 23 calories each.

DIABETIC BISCUITS.

1 Box Lister's Diabetic Flour
3 Eggs
} Makes six Biscuits

Each biscuit contains protein, 9.70 grams; fat, 3.05 grams; calories, 66.

METHOD.—Separate whites and yolks of eggs. Add to whites salt to taste. Beat whites until very thick. Beat yolks until thick and lemon colored. Combine and beat with egg-beater. Fold in gradually one box of Lister's Diabetic Flour. Divide into six parts if Lister's Baking Biscuit Tins are used. Have oven moderately hot. If baked in gas-stove oven, bake from fifteen to twenty minutes. If baked in coal or wood oven, bake from fifteen to thirty minutes. Do not open oven door until biscuits are done. Do not remove from tin until partly cooled. If desired

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these biscuits may be flavored to taste with nutmeg, cinnamon, ginger or cloves. If the biscuits are to be kept for several hours, wrap them in a cloth.

FRENCH TOAST.

1 Egg
2 or 3 tablespoonfuls cream
Lister's Muffins, Biscuits or Bread

Beat the egg and cream together. Slice Lister's Muffins, Biscuits or Bread. Soak the slices in the egg and cream and fry in a little hot butter until light brown.

Follow all directions exactly as given. The batter may appear to be too thick or heavy but no more moisture should be added than is called for in these directions.

BAKED SOY BEANS.

Yellow Soy beans, 120 grams, are soaked for forty-eight hours, then boiled for about half an hour and finally baked with 30 grams pork for twelve hours. The food value is approximately as follows:

	Carbohydrate, grams.	Protein, grams.	Fat, grams.
Soy beans, 120 grams	0	48	24
Pork, 30 grams	0	4	12
Baked Soy Beans and Pork	0	52	36

SEA MOSS.

Sea moss farina and Irish moss are usually allowable for diabetic patients. Most of the carbohydrate in these materials is in the form of pentosans and galactans, which Swartz[1] has shown to be quite inert in the body. Unfortunately these products are sometimes adulterated with other carbohydrates. This emphasizes the fact that no matter how useful a food may be in itself, one must always be on the lookout for adulteration.

[1] Swartz: Tr. Conn. Acad. Arts and Sc., 1911, xvi, p. 247.

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HEPCO CAKES.

So arranged that one cake is equivalent to an egg.

	Protein.	Fat.
Hepco flour, 140 grams	60	29
Eggs (2)	12	12
Cream, 40 per cent., 60 c.c.	2	24
Butter, 10 grams	..	9
	74	74

Make twelve cakes. Each cake contains 6 grams protein, 6 grams fat, and approximately 75 calories.

BRAN BISCUITS FOR CONSTIPATION.

The following rule was given me by Dr. F. M. Allen:

Bran	60	grams
Salt	½	teaspoonful
Agar agar, powdered	6	grams
Cold water	100	c.c. (½ glass)

Tie bran (for character of bran to purchase see p. 122) in cheesecloth and wash under cold water tap until water is clear. Bring agar agar and water (100 c.c.) to the boiling-point. Add to washed bran the salt and agar agar solution (hot). Mold into two cakes. Place in pan on oiled paper, and let stand half an hour; then, when firm and cool, bake in moderate oven thirty to forty minutes.

The bran muffins naturally will be far more palatable if butter and eggs are added. This may be done providing the patient allows for this in the diet. If the patient is not upon a measured diet, then considerable latitude can be employed in making the bran cakes.

BRAN CAKES FOR DIABETICS.

Food.	Amount.	Protein, grams.	Fat, grams.	Carbo-hydrate, grams.	Calories.
Bran	2 cupfuls				
Melted butter	30 grams	..	25	..	225
Eggs (whole) 2	....	12	12	..	156
Egg white (1)	25 grams	3	..	..	12
Salt	1 teaspoonful				
Water.					
		15	37	0	393

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Tie bran in cheesecloth and wash thoroughly by fastening on to the water tap, until the water comes away clear. The bran should be frequently kneaded so that all parts come in contact with the water. Wring dry. Mix bran, well-beaten whole eggs, butter and salt. Beat the egg white very stiff and fold in at the last. Shape with knife and tablespoon into three dozen small cakes. If desired one-half gram of cinnamon or other flavoring may be added. Each cake contains: protein, 0.5 gram; fat, 1 gram; calories, 11.

CRACKED COCOA.

Cracked cocoa (cocoa nibs) makes a most useful drink for diabetic patients. This is not generally appreciated by the profession.

The sample of cracked cocoa (cocoa nibs) used has been purchased of the S. S. Pierce Co., Boston. It was analyzed by Professor Street, with the following result:

Moisture	2.83
Protein	14.69
Fat	51.42
Fiber	4.32
Ash	3.88
Starch	7.48
Reducing sugar, as dextrose, direct	none
Reducing sugar, as dextrose, after inversion	0.94

The cocoa is prepared for the table by adding a cupful of the cracked cocoa to a quart of water and letting it simmer on the back of the stove all day, adding water from time to time.

Professor Street was good enough to analyze the infusion, and wrote me: "The cocoa prepared according to directions contained 0.032 per cent. of reducing sugar as dextrose direct and 0.138 per cent. of total reducing sugars."

LEMON JELLY (DIABETIC).

Food.	Amount.	Protein, grams.	Fat, grams.	Carbohydrate, grams.	Calories.
Lemon juice	30 c.c.	..	..	3	12
Water	50 c.c.				
Gelatin	4 grams	4	..	..	16
Saccharin (to sweeten)					
Cream, 40 per cent.	30 c.c.	1	12	1	116
		5	12	4	144

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Soften gelatin in a part of the cold water. Heat the remaining water and lemon juice and pour over the gelatin. Stir until dissolved. Add saccharin, strain into cups. Serve with cream.

BAVARIAN CREAM (DIABETIC).

Food.	Amount.	Protein, grams.	Fat, grams.	Carbohydrate, grams.	Calories.
Cream, 40 per cent.	90 c.c.	3	36	3	348
Water	10 c.c.				
Egg (1)	50 grams	6	6	..	78
Gelatin	2 grams	2	..	..	8
Saccharin (to sweeten)					
Flavoring (to taste)					
		11	42	3	434

Soften the gelatin in cold water, then add to the cream, which has been heated. Stir until dissolved, pour on the beaten egg, cook like soft custard, turn into mold and chill.

ICE CREAM (DIABETIC).

Food.	Amount.	Protein, grams.	Fat, grams.	Carbohydrate, grams.	Calories.
Cream, 40 per cent.	90 c.c.	3	36	3	348
Water	10 c.c.				
Egg (1)	50 grams	6	6	..	78
Saccharin (to sweeten)					
Flavoring (to taste)					
		9	42	3	426

Make a soft custard of the egg, 50 c.c. of the cream, and the water. Whip the remaining 40 c.c. of cream and fold into custard. The saccharin may be added to the egg. The flavoring should be added last.

AGAR AGAR JELLY.

One-quarter of an ounce sufficient to make one quart of jelly. Agar agar may also be added to broths.

Miss E. Grace McCullough, Dietitian at the Peter Bent Brigham Hospital, has given me several practical suggestions about the preparation of hospital diabetic diets. Many of these have been incorporated in what follows.

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THRICE-COOKED VEGETABLES.

The vegetables are cleaned, cut up fine, soaked in cold water and then strained. The vegetables are then tied up loosely in a large square of double cheesecloth—large enough so that the corners of the cloth, after it has been tied up with a string, make conveniently long ends, and also large enough to allow the vegetables to swell without sticking together. They are then transferred to fresh cold water, placed on the fire, and brought to the boiling-point, at which temperature they are maintained for from three to five minutes. This water is then poured off and replaced by fresh, and the vegetables again boiled a similar length of time. Three changes of water are usually sufficient to remove the carbohydrate, as has been proved by Professor Wardall's preliminary experiments. The pots for the vegetables should be of sufficient size to hold a large quantity of water, and in a hospital, vegetables enough for the daily supply of six patients. Vegetables thus cooked will keep in cold storage two or more days, and the reheating of the same in a steamer is a simple affair.

If the vegetables are cooked with the cover left off the pot they will be lighter in color and the flavor not so strong.

Miss McCullough has adopted several expedients by which variety in the 5 per cent. vegetables is obtained, and thus the monotony of the diet avoided. She suggests that the large outer stalk—slightly green covering—of cauliflower be carefully cleaned, cut into half-inch pieces and boiled until tender, and frequently this is transferred from four waters. Similarly the green outside leaves and any small pieces of lettuce may be shredded and served like spinach. Chard in season can be purchased by the bushel, cut, and then chopped up. Rhubarb retains its acid flavor and has proved so acceptable an addition to the diet that in the future it should be canned by the cold-water method for subsequent use. The flat, large, celery stalks with any or all the leaves, whether yellow or green, chopped fine, serve excellently well. White, green, and red cabbage is cut fine and served as cold slaw.

Diabetic patients should be urged, whenever possible, to

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have a garden and to raise suitable vegetables for themselves for the ensuing winter. One of my patients does this and thus provides himself with the best of celery, cabbage, lettuce, etc. This patient eats a slice of cabbage, cut as one buys cheese in a grocery store, for breakfast each morning, and by this means keeps the bowels perfectly regular.

Canned vegetables which have been of the most service at the Peter Bent Brigham Hospital are of four varieties: soup asparagus, broad, flat, cut string beans, the tender, green, stringless bean, and the white wax beans. The pods are separated from the beans, the latter being used for the benefit of other patients. Soup asparagus proved to be excellent for hospital use. It is a by-product of the factory and consists of the broken-off tips and the shorter thin stalks which are unfit for the standard size. The pieces are about one inch long and are all edible.

SQUAB.

A squab when carefully boned yields 50 grams of meat. This is broiled in an oiled paper case to prevent evaporation, and when served with the escaped juices proves a favorite dish for patients. It contains about 12 grams protein and 5 grams fat.

BOILED DINNER.

Corned beef, with cabbage and one other vegetable, served together as a boiled dinner, is most acceptable to male patients. A portion containing 50 to 75 grams of meat and 100 grams of each vegetable makes an excellent meal. Corned-beef hash made of meat and vegetables in the same proportion could also be served for variety.

The proper seasoning of the food is a great help to the diabetic patient. So many articles are excluded from the diet that the great variety which is possible in the preparation of the food by the help of seasoning is overlooked. Horseradish, to be sure, contains 10 per cent. of carbohydrate, but it would take at least two teaspoonfuls to contain a gram, and probably far more. Sour pickles are allowable,

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and other pickles made from the group of 5 per cent. vegetables, provided one is assured that they have been prepared without sweetening. Mint, capers, curry, tarragon vinegar, onion, bay leaf and cloves may all be used as seasoning, and tomato and onion stewed, to which bay leaf and cloves may be added and then thickened with Irish moss, serves as a sauce.

SEVEN MENUS FOR A SEVERE DIABETIC.

For the menus and the recipes which make them possible I am greatly indebted to Miss Alice Dike, Instructor in Household Economics at Simmons College, and to Case No. 765. The directions given were as follows:

Daily dietetic prescription.[1]	Carbohydrate, grams.	Protein, grams.	Fat, grams.
Five per cent. vegetables, 300 grams	10	5	0
Eggs, 2	0	12	12
Bacon, 30 grams	0	5	15
Butter, 30 grams	0	0	25
Cream, 60 grams, 40 per cent.	2	2	24
Meat, 120 grams	0	32	20
Lister roll (2)	0	12	12
	12	68	108

The calories furnished amount to about 1200—a maintenance diet for a patient weighing 40 kilograms and a sufficient diet for a patient of 50 kilograms when in bed.

FIRST DAY.

Breakfast.

Soft-boiled egg, 1.
Fried bacon, 30 grams.
Lister roll and butter, 8 grams.
Coffee and cream, 30 grams.

Lunch.

Roast beef, 60 grams; grated horseradish.
String beans, 75 grams, and butter, 7 grams.
Lettuce and cucumber salad, 50 grams.
Rhubarb jelly and meringue (rhubarb, 25 grams, and ½ white of egg).

[1] These represented the dietetic orders for one week, and from the foods mentioned in the list the menus which follow were prepared.

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Dinner.

Chicken, 60 grams.
Cauliflower, 75 grams, and butter, 7 grams.
Celery and olives, 75 grams.
Lister roll and butter, 8 grams.
Coffee Spanish cream (egg 1 and cream 30 grams).

SECOND DAY.

Breakfast.

Shirred egg, 1.
Fried bacon, 20 grams.
Lister roll and butter, 8 grams.
Coffee and cream, 30 grams.

Lunch.

Boiled haddock, 60 grams.
Cucumber sauce, 25 grams.
Butter, 6 grams.
Spinach, 75 grams, and butter, 8 grams, and ½ egg.
Lettuce, 30 grams.
Coffee jelly whip.

Dinner.

Lamb chops, 60 grams; tomato sauce, 45 grams.
Asparagus, 75 grams and butter, 8 grams.
Dandelion greens, 50 grams, and bacon, 10 grams.
Lister cream puff and custard.

THIRD DAY.

Breakfast.

Egg, 1; scrambled with tomato, 50 grams.
Bacon, 20 grams.
Lister roll and butter, 8 grams.
Coffee and cream, 30 grams.

Lunch.

Vegetable hash (corned beef, 40 grams; cabbage, 80 grams; onions, 10 grams; beet, 10 grams; bacon, 10 grams).
Lettuce, 30 grams.
Lister roll and butter, 8 grams.
Tea.

Dinner.

Steak, 80 grams, and butter, 7 grams.
Broiled pepper, 25 grams.
Cauliflower, 75 grams, and butter, 7 grams.
Wine jelly and egg and cream sauce (egg, 1, and cream, 30 grams).

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FOURTH DAY.

Breakfast.

Liver, 40 grams, and bacon, 15 grams.
Lister roll and butter, 10 grams.
Coffee and cream, 15 grams.

Lunch.

Ham omelet (egg, 1, and meat, 20 grams).
Bacon, 15 grams.
Salad, 150 grams (celery, cabbage, lettuce).
Lister roll, butter, 10 grams.
Cracked cocoa and cream, 15 grams.

Dinner.

Roast lamb, 60 grams, and mint sauce.
Sliced tomatoes, 75 grams.
String beans, 75 grams, and butter, 10 grams.
Vanilla ice-cream (egg, 1, and cream, 30 grams).

FIFTH DAY.

Breakfast.

Scrambled egg, 1, and dried beef, 20 grams.
Lister roll and butter, 6 grams.
Coffee and cream, 20 grams.

Lunch.

Spinach soup (spinach, 25 grams; cream, 15 grams; yolk 1 egg, stock).
Bacon, 30 grams; fried with egg plant, 125 grams.
Coffee.

Dinner.

Steak, 100 grams, and water cress, 25 grams; "Maitre d'Hôtel" butter, 10 grams.
Vegetable marrow, 125 grams, and butter, 8 grams.
Lister roll and butter, 6 grams.
Cracked cocoa whip (white 1 egg and cream, 25 grams).

SIXTH DAY.

Breakfast.

Fried fish cakes and butter, 6 grams (fish, 40 grams; egg, 1; cream, 15 grams).
Sliced cucumbers on lettuce, 75 grams.
Coffee and cream, 15 grams.

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Lunch.

Fried egg, 1, and bacon, 30 grams.
Lister roll and butter, 10 grams.
Cold slaw, 75 grams.
Tea.

Dinner.

Broiled swordfish, 80 grams (drawn butter sauce, 7 grams, and parsley).
Brussels sprouts, 100 grams, and butter, 7 grams.
Tomato jelly salad, 50 grams.
Lister roll and whipped cream, 30 grams (flavored with coffee).

SEVENTH DAY.

Fasting.

RECIPES USED IN PREPARING THE PRECEDING MENUS.

Grated Horseradish Sauce.

1½ teaspoonfuls grated horseradish.
½ teaspoonful vinegar.
⅛ teaspoonful salt.
Cayenne.
2 teaspoonfuls cream or water.
Mix first four ingredients and add cream beaten stiff.

Cucumber Sauce.

Grate 25 grams cucumber and season with salt, pepper and vinegar.

Tomato Sauce.

Stew 45 grams tomato, season with salt, pepper, clove and bay leaf. Irish or sea moss may be used for thickening.

Parsley Sauce.

7 grams butter.
1 teaspoonful chopped parsley.
Salt and pepper.
Add parsley to melted butter just before serving.

Mint Sauce.

⅛ cup finely chopped mint leaves.
¼ cup vinegar.
1 grain saccharin.
Add saccharin to vinegar and dissolve, pour over mint and let stand thirty minutes on back of range. Let cool before serving.

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Maitre d'Hotel Butter.

10 grams butter.
Salt and pepper.
1 teaspoonful chopped parsley.
½ teaspoonful lemon juice.
Put butter in bowl and with wooden spoon work until creamy. Add seasoning and lemon juice slowly.

Coffee Spanish Cream.

1 scant teaspoonful gelatin soaked in 1 tablespoonful cold water and dissolved in 5 tablespoonfuls hot coffee.
Add 30 grams cream and pour on slightly beaten yolk of egg.
Cook like soft custard and pour while hot on stiffly beaten white of egg.
Saccharin.

Rhubarb Jelly with Meringue.

1 teaspoonful gelatin soaked in 1 tablespoonful cold water and dissolved in sauce made by cooking rhubarb in enough water to make 7 tablespoonfuls.
Serve garnished with beaten white of egg flavored with vanilla.
Saccharin.

Coffee Jelly Whip.

Make the same as plain coffee jelly, but just before it hardens beat in an egg beaten until fluffy.
Saccharin.

Lister Cream Puff.

Lister biscuit with soft custard poured over it. The soft custard is made as follows:
30 grams cream.
½ egg.
2 tablespoonfuls water.
Saccharin and flavoring as desired.

Wine Jelly with Custard Sauce.

1 scant teaspoonful gelatin soaked in 1 teaspoonful cold water and dissolved in 4 tablespoonfuls boiling water and flavored with 3 tablespoonfuls wine and saccharin.
Serve with sauce used above for Lister cream puff.

Cracked Cocoa Whip.

1 scant teaspoonful gelatin, soaked in 1 tablespoonful water, dissolved in 5 tablespoonfuls strong hot cocoa.
When cooled to the consistency of thick cream, pour slowly on the beaten white of an egg, beating all the time. Mold and chill.

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Spinach Soup.

25 grams spinach.
15 grams cream.
Yolk of 1 egg.
½ cup beef or chicken stock.

Add stock to cooked spinach and cook five minutes. Then rub through sieve. Beat yolk of egg with cream. Add spinach and stock and return to double boiler. Cook one minute and serve at once.

INEXPENSIVE MENUS.

Diet for Day.

	Carbohydrate, grams.	Protein, grams.	Fat, grams.
Five per cent. vegetables, three times washed, 300 grams	0	0	0
Eggs, 2	0	12	12
Bacon, 30 grams	0	5	15
Oleo or butter, 50 grams Lard or crisco, 45 grams	0	0	41
Meat, 120 grams	0	32	20
Hepco cakes, 2	0	12	12
	0	61	100

FIRST DAY.

Breakfast.

Fried egg, 1, and bacon, 30 grams.
Hepco cake, 1, and oleo, 15 grams.
Coffee.

Dinner.

Boiled dinner:
Corned beef, 80 grams.
Cabbage, 150 grams.
Oleo, 10 grams.
Pickle.
Hepco cake, 1, and oleo, 15 grams.
Tea and coffee.

Supper.

Vegetable and corned beef hash with fried egg:
Corned beef, 40 grams.
Cabbage, 150 grams.
Oleo, 10 grams.
Tea or coffee.

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SECOND DAY.

Breakfast.

Egg, 1; scrambled with tomato, 50 grams.
Bacon, 15 grams.
Hepco cake, 1, and oleo, 15 grams.
Tea or coffee.

Dinner.

Hamburg steak, 80 grams.
Onions (30 grams) fried in 10 grams oleo, 60 grams.
Greens, 90 grams, with egg, 1, and oleo, 10 grams.
Hepco cake, 1, and oleo, 15 grams.
Tea or coffee.

Supper.

Meat (liver), 40 grams, with bacon, 15 grams.
Cold slaw, 100 grams (cabbage, vinegar, salt, pepper).

THIRD DAY.

Breakfast.

Boiled egg, 1.
Bacon, 30 grams.
Hepco cake, 1, and oleo, 15 grams.
Coffee.

Dinner.

Boiled cod, 80 grams, with oleo, 10 grams, and vinegar.
String beans, 150 grams, and oleo, 10 grams.
Hepco cake, 1, and oleo, 15 grams.

Supper.

Sardines, 40 grams, with hard-boiled egg, 1.
Sauerkraut, 150 grams.
Tea or coffee.

PICNIC LUNCHES.

FIRST DAY.

Dinner.

Lister sandwich: 1 Lister roll, chicken, 60 grams, cucumber, 75 grams.
Hard-boiled egg.
Olives.
Tea or coffee.

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Supper.

Sardines, 60 grams.
Lister roll and butter.
Lettuce, radish, and celery, 75 grams.
Ripe tomato, 50 grams.

SECOND DAY.

Dinner.

Sliced veal loaf sandwiches (1 Lister roll).
Dressed cabbage, 75 grams.
Custard (½ egg).
Coffee.

Supper.

Salad (cold halibut, egg, ½, cucumber, 75 grams).
Lemon or rhubarb jelly.
Brazil nuts.

THIRD DAY.

Dinner.

Cold lamb chop.
Tomato.
Olives and pickles.
Lister cream puff.

Supper.

Salad: egg.
Lister sandwich: Lister roll, cold bacon, lettuce.
Coffee Bavarian cream.

FOURTH DAY.

Dinner.

Egg baked in tomato with cheese on top.
Ham sandwich: 1 Lister roll.
Swiss chard.
Coffee jelly.

Supper.

Sandwich: cold roast beef, 1 Lister roll, lettuce and horseradish.
Rhubarb sauce.

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CHAPTER II.

DIET TABLES.

THE improvement in the treatment of diabetes owes much to the recent dissemination of knowledge regarding the composition of foods. To the United States Government we are indebted for an excellent monograph by Atwater and Bryant entitled "The Chemical Composition of American Food Materials, Bulletin No. 28, revised edition," which was first issued in 1906. This can be purchased by sending ten cents in coin to the Superintendent of Documents, Washington, D. C. From this I have abstracted such analyses as are especially useful in computing the diets of both normal and diabetic individuals and have computed the calories per 100 grams instead of recording the same per pound.

Analyses are also inserted published by the Connecticut Agricultural Experiment Station. Most of these analyses are concerned with the so-called diabetic foods, but in some cases other analyses are included as well. To these latter lists the values of protein and fat have been added. Whereas the analyses of many so-called diabetic foods are recorded, no special food is recommended. In general the cost of these special foods is greater than that of the common foods selected from the ordinary diet; in fact, the patient pays for the taste. Each physician must decide the merits of any particular food for himself.

The arrangement of the analyses is as follows:

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VEGETABLES: FRESH.

	Protein, per cent.	Fat, per cent.	Carbohydrates, per cent.	Caloric value per 100 grams.
Rhubarb	0.6	0.7	2.5	19
Endive	1.0	0.0	2.6	15
Vegetable marrow	0.1	0.2	2.6	13
Sorrel	..	..	3.0	12
Sauerkraut	1.7	0.5	3.0	24
Beet greens, cooked	2.2	3.4	3.2	54
Celery	0.9	0.1	3.3	18
Tomatoes	0.9	0.4	3.3	21
Brussels sprouts	1.5	0.1	3.4	21
Watercress	0.7	0.5	3.7	23
Sea-kale	1.4	0.0	3.8	21
Okra	1.6	0.2	4.0	25
Cauliflower	1.8	0.5	4.3	30

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	Protein, per cent.	Fat, per cent.	Carbohydrate, per cent.	Caloric value per 100 grams.
Egg plant	1.2	0.3	4.3	25
Cabbage (range 3.0– 6.5)	1.6	0.3	4.7	29
Radishes (range 2.7– 7.5)	1.3	0.1	5.0	27
Leeks	1.0	0.4	6.0	32
Mushrooms[1] (range 2.0–18.0)	3.5	0.4	6.0	43
Pumpkins (range 3.0–14.0)	1.0	0.1	6.0	30
String beans (range 3.9–10.0)	2.3	0.3	6.0	37
Turnips (range 2.3–18.0)	1.3	0.2	6.0	32
Celery root	..	..	6.3	26
Kohl-rabi (range 3.5–14.0)	2.0	0.1	7.0	38
Oyster plant	1.2	0.1	7.0	35
Rutabagas (range 3.0–12.0)	1.3	0.2	7.0	36
Truffles	9.1	0.5	7.0	71
Squash (range 3.0–15.0)	1.4	0.5	8.0	43
Beets (range 6.0–10.0)	1.6	0.1	9.0	44
Carrots (range 5.9–11.5)	1.1	0.4	9.0	45
Onions (range 4.0–14.0)	1.6	0.3	9.0	46
Parsnips (range 6.0–14.0)	1.6	0.5	11.0	56
Chicory	..	..	15.0	62
Peas	7.0	0.5	15.0	95
Artichokes[2]	2.6	0.2	16.0	78
Yams	..	..	16.0	66
Corn	3.1	1.1	19.0	101
Potatoes (range 13.0–27.0)	2.2	1.1	20.0	101
Lima beans	7.1	0.7	22.0	126
Sweet potatoes (range 16.5–44.5)	1.8	0.7	26.0	120
Soy beans[2] (range 19.3–39.0)	20.0	43.0	28.0	467
Lettuce	1.2	0.3	2.2	17
Cucumbers	0.8	0.2	2.3	15
Spinach	2.1	0.3	2.3	21
Asparagus	1.8	0.2	2.4	19

VEGETABLES: CANNED.

Beans, haricot-verts	1.1	0.1	2.0	14
Asparagus (range 1.6– 3.3)	1.5	1.1	2.3	26
Brussels sprouts	1.5	0.1	2.9	19
Okra	0.7	0.1	2.9	16
Tomatoes (range 1.0– 4.5)	1.2	0.2	3.0	19
String beans (range 1.5– 4.5)	1.1	0.1	3.3	19
Macedoine, mixed vegetables (range 1.9– 5.0)	1.4	0.0	3.9	22

[1] The carbohydrate which these contain is to a considerable extent unassimilable, and patients often eat these with impunity, as I have found since my attention was called to this fact by Professor Wardall.

[2] French artichokes. According to König, canned artichokes contain 92.46 per cent. water, 0.79 per cent. protein, 0.02 per cent. fat, 4.43 per cent. carbohydrates.

[3] The carbohydrate is non-assimilable.

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		Protein, per cent.	Fat, per cent.	Carbohydrates, per cent.	Caloric value per 100 grams.
Artichokes	(range 3.2– 6.1)	0.8	0.0	4.4	21
Pumpkins	(range 3.6– 7.3)	0.8	0.2	6.0	30
Peas	(range 4.3–17.2)	3.6	0.2	10.0	58
Squash	(range 3.6–12.8)	0.9	0.5	10.0	49
Beans, haricot-flageolets	(range 9.8–12.4)	4.6	0.1	11.0	65
Lima beans	(range 9.6–16.5)	4.0	0.3	13.0	72
Baked beans		6.9	2.5	17.0	121
Red kidney beans		7.0	0.2	17.0	100
Corn	(range 11.7–25.1)	2.8	1.2	18.0	97
Succotash	(range 13.9–21.3)	3.6	1.0	18.0	98
Beans		22.5	1.8	55.0	334
Cow peas		21.4	1.4	55.0	326
Peas		24.6	1.0	58.0	348
Lentils		25.7	1.0	59.0	357
Lima beans		18.1	1.5	66.0	359
FRUITS AND BERRIES: FRESH.					
Strawberries		1.0	0.6	5.0	30
Grape fruit		..	..	6.0	25
Alligator pear		..	..	7.0	29
Lemons		1.0	0.9	7.0	31
Watermelons		0.3	0.1	7.0	32
Blackberries		0.9	2.1	8.0	56
Cranberries		0.5	0.7	8.0	41
Peaches		0.5	0.2	9.0	41
Muskmelons		0.7	0.3	10.0	47
Raspberries		1.0	?	10.0	45
Whortleberries		0.7	3.0	10.0	72
Apples		0.4	0.5	11.0	71
Pears		0.4	0.6	11.0	72
Apricots		1.1	?	12.0	54
Gooseberries		0.4	..	12.0	51
Mulberries		0.3	..	12.0	48
Pineapples		0.4	0.3	12.0	54
Currants		0.4	..	13.0	55
Oranges		0.9	0.6	13.0	63
Mangoes		..	..	13.0	53
Grapes		1.0	1.0	15.0	75
Nectarines		0.6	?	15.0	64
Cherries		0.8	0.8	17.0	80
Figs		1.5	..	17.0	76
Huckleberries		0.6	0.6	17.0	78
Plums		1.0	..	17.0	74
Pomegranates		1.5	1.6	17.0	91
Prunes		0.8	?	19.0	81
Bananas		1.5	0.7	20.0	95
Persimmons		0.8	0.7	32.0	141
Dates		1.9	Trace	54.0	229

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ORANGES.[1]

	Protein, per cent.	Fat, per cent.	Carbohydrates, per cent.	Caloric value per 100 grams.
Florida, average of seven analyses (soluble portion)			8.0	33
California, average of eight analyses (soluble portion)			8.3	34

BANANAS.

Yellow	1.3	0.6	22.0	101

GRAPE FRUIT.

Porto Rico, average of two analyses (soluble portion)			8.2	34
California, average of four analyses (soluble portion)			6.9	28
Florida, average of four analyses (soluble portion)			6.6	27

FRUITS: CANNED.

Peaches	0.7	0.1	11.0	49
Blueberries	0.6	0.6	13.0	61
Pineapples (range 6.0–25.0)	0.4	0.7	15.0	70
Apricots	0.9	?	17.0	73
Pears	0.3	0.3	18.0	78
Cherries	1.1	0.1	21.0	92
Crab apples	0.3	2.4	54.0	245
Blackberries	0.8	2.1	56.0	252

Jams, jellies, preserves and marmalade contain 47 per cent. or more carbohydrate.

FRUITS: DRIED.

Contain 63 per cent. or more of carbohydrate.

PICKLES AND CONDIMENTS.

Distilled vinegar	0	0	0	0
Cider vinegar[2]	0	0	0.25	1
Cucumber pickles	0.5	0.3	2.7	16
Olives, ripe	1.7	25.9	4.3	265
Capers	3.2	0.5	5.0	41
Prepared mustard	4.7	4.1	5.0	78
Prepared mustard plus cereal (range 4.0–15.0)	3.5	1.9	7.0	61
Ketchup (range 3.0–26.0)	1.8	0.2	10.0	50
Spiced salad vinegar	..	..	10.0	41
Horseradish	1.4	0.2	11.0	53
Chili sauce (range 14.0–28.0)	..	..	20.0	82
Spiced pickles	0.4	0.1	21.0	89
Olives, green[3]	2.1	12.9	1.8	137
Olives, ripe	2.0	21.0	4.0	220
Peppers (paprica), green, dried	15.5	8.5	63.0	400

[1] If carbohydrate in oranges is reckoned at 10 per cent., comparatively little error will result.

[2] Professor Street writes (November 27, 1916), "In our last examination of 27 brands we found the reducing sugars to range from 0.27 to 1.52 per cent."

[3] Univ. Calif. College Agriculture, 1916. Personal communication.

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NUTS.

	Protein, per cent.	Fat, per cent.	Carbohydrates, per cent.	Caloric value per 100 grams.
Filberts	15.6	65.3	13.0	724
Hickory nuts	15.4	67.4	11.4	736
Peanuts	25.8	38.6	24.4	563
Pecans	11.0	71.2	13.3	760
Pine nuts; pignolias	33.9	49.4	6.9	626
Pistachios, first quality, shelled	22.3	54.0	16.3	659
Walnuts, California	18.4	64.4	13.0	726
Walnuts, California, black	27.6	56.3	11.7	683
Walnuts, California, soft shell	16.6	63.4	16.1	723
Almonds	21.0	54.9	17.3	667
Brazil	17.0	66.8	7.0	364
Butternuts	27.9	61.2	3.5	95
Chestnuts, fresh	6.2	5.4	42.1	248
Cocoanuts	5.7	50.6	27.9	607

	Nut Preparations.	Protein, per cent.	Fat, per cent.	Carbohydrate per cent.	Starch, per cent.	Calculated calories per 100 grams.
	The Kellogg Food Co., Battle Creek, Mich.:					
1913	Nut Bromose (Meltose and Nuts)	17.1	26.8	39.4	3.2	467
1906	Nut Butter (Sanitas)	28.8	50.5	13.9	9.1[1]	625
1906	Nut Meal (Sanitas)	29.0	51.7	12.1	8.9[1]	630
1906	Nuttolene (Sanitas)	12.7	21.8	6.3	..	272
1906	Protose (Sanitas)	22.6	9.2	3.6	..	188
1913	Nashville Sanitarium Food Co., Nashville, Tenn.:					
	Nut Butter	28.0	52.6	13.0	3.8	637
1913	Nutcysa	12.9	21.0	6.3	trace	266
1913	Nutfoda	20.8	8.0	6.8	trace	182
	MALTED NUTS.					
1901	The Kellogg Food Co., Battle Creek, Mich.:					
	Malted Nuts	23.7	27.6	43.9	..	519
1913	Nashville Sanitarium Food Co., Nashville, Tenn.:					
	Malted Nut Food	24.7	42.7	27.5	3.4	593

[1] Determined by the diastase method, without previous washing with water, and calculated as starch.

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DAIRY PRODUCTS, ETC.

	Protein, per cent.	Fat, per cent.	Carbohydrates, per cent.	Caloric value per 100 grams.
Milk, whole	3.3	4.0	5.0	72
Milk, condensed, sweetened	8.8	8.3	54.1	334
Milk, condensed, unsweetened, "evaporated cream"	9.6	9.3	11.2	172
Milk, skimmed	3.4	0.3	5.1	37
Cream, approximately 20 per cent. fat	2.3[1]	18.5	4.5	194
Cream, 40 per cent. fat	1.5[1]	40.0	3.0	378
Buttermilk	3.0	0.5	4.8	36
Whey	1.0	0.3	5.0	27
Kephir	3.1	2.0	1.6	38
Koumiss	2.8	2.0	5.4	53

	Protein, per cent.	Fat, per cent.	Carbohydrate per cent.	Starch, per cent.	Caloric value per 100 grams.
Butter	1.0	85.0	..	..	793
1913 S. S. Pierce Co., Boston: Acharis Brand peanut butter	28.7	48.3	14.6	5.1	608
OILS AND FATS.					
Lard, tallow, oleomargarine, cod-liver oil, olive oil and other edible oils (crisco, oleo. E. P. J.)	..	85 to 100	..	..	900

	Protein, per cent.	Fat, per cent.	Carbohydrates, per cent.	Caloric value per 100 grams.
Cheese, American, pale	28.8	35.9	0.3	452
" " red	29.6	38.3	..	476
" Camembert	21.0	21.7	..	290
" Cottage	20.9	1.0	4.3	112
" Dutch	..	17.7	..	316
" Full cream	25.9	33.7	2.4	429
" Limburger	23.0	29.4	0.4	369
" Neufchatel	18.7	27.4	1.5	337
" Pineapple	29.9	38.9	2.6	494
" Roquefort	22.6	29.5	1.8	374
" Skimmed milk	31.5	16.4	2.2	290
" Swiss	27.6	34.9	1.3	442

[1] Estimated, E. P. J.

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Meat.

	Protein, per cent.	Fat, per cent.	Carbohydrates, per cent.	Caloric value per 100 grams.
Beef, cooked:				
Roast	22.3	28.6	..	356
Round steak, fat removed	27.6	7.7	..	185
Calf's foot jelly	4.3	0.0	17.0	87
Beef, canned:				
Dried beef	39.2	5.4	..	211
Beef, corned and pickled:				
Corned beef, all analyses	15.6	26.2	..	307
Mutton, cooked:				
Mutton, leg roast	25.0	22.6	..	312
Pork, pickled, salted and smoked:				
Ham, smoked, lean	19.8	20.8	..	274
Bacon, smoked, all analyses	10.5	64.8	..	645
Sausage, A:				
Bologna sausage (range 0.2– 3.1)	18.7	17.6	0.6	243
Frankfort (range 0.0– 6.6)	19.6	18.6	1.1	258
Pork (range carbohydrate 0.0–8.6)	13.0	44.2	1.1	468
Deerfoot Farm, cooked, analysis furnished by the manufacturers	19.93	54.21	0.34	587
Poultry and game, fresh:				
Chicken, broilers	21.5	2.5	..	111
Fowls	19.3	16.3	..	230
Goose, young	16.3	36.2	..	403
Turkey	21.1	22.9	..	299
Liver:				
Beef	21.0	4.5	1.7	133
Chicken, as purchased	22.4	4.2	2.4	141
Goose, as purchased	16.6	15.9	3.7	231
Mutton, as purchased	23.1	9.0	5.0	199
Pork, as purchased	21.3	4.5	1.4	135
Turkey, as purchased	22.9	5.2	0.6	144
Veal, as purchased	19.0	5.3	..	127

Fish: Fresh.

Cod sections	16.7	0.3	..	72
Flounder, whole	14.2	0.6	..	64
Haddock, entrails removed	17.2	0.3	..	74
Halibut, steaks or sections	18.6	5.2	..	124
Mackerel, whole	18.7	7.1	..	142
Salmon, whole	22.0	12.8	..	209
Shad, whole	18.8	9.5	..	165
Trout (brook), whole	19.2	2.1	..	98

Fish: Preserved and Canned.

Cod, salt, "boneless"	27.3	0.3	..	108
Herring, smoked	36.9	15.8	..	298
Sardines, canned	23.0	19.7	..	277
Shad roe	20.9	3.8	2.6	121
Sturgeon caviare	30.0	19.7	8.0	198

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Shell-fish.

	Protein, per cent.	Fat, per cent.	Carbo-hydrates, per cent.	Caloric value per 100 grams.
Clams, long, in shell	8.6	1.0	2.0	53
Crabs, hardshell, whole	16.6	2.0	1.2	91
Lobster, whole	16.4	1.8	0.4	86
Mussels, in shell	8.7	1.1	4.1	63
Oysters, in shell	6.2	1.2	3.7	52
Scallops, as purchased	14.8	0.1	3.4	76
Terrapin	21.2	3.5	..	120
Turtle, green, whole	19.8	0.5	..	86

Gelatin.

Gelatin[1]	91.4	0.1	..	375

Eggs.

Eggs, edible portion:[2]				
Hens', uncooked	13.4	10.5	..	158
Hens', boiled	13.2	12.0	..	168
Hens', boiled whites	12.3	0.2	..	55
Hens', boiled yolks	15.7	33.3	..	376

Soups: Home-made

Beef	4.4	0.4	1.1	26
Bean	3.2	1.4	9.4	65
Chicken	10.5	0.8	2.4	61
Clam chowder	1.8	0.8	6.7	43
Meat stew	4.6	4.3	5.5	81

Soups: Canned.

Bouillon	2.2	0.1	0.2	11
Chicken gumbo	3.8	0.9	4.7	43
Chicken soup	3.6	0.1	1.5	22
Consomme	2.5	..	0.4	12
Julienne	2.7	..	0.5	13
Mock turtle	5.2	0.9	2.8	41
Mulligatawny	3.7	0.1	5.7	40
Oxtail	4.0	1.3	4.3	46
Pea soup	3.6	0.7	7.6	52
Tomato soup	1.8	1.1	5.6	41
Vegetable	2.9	..	0.5	14

[1] I understand that many of the brands of commercial gelatin contain from 83 to 87 per cent. gelatin, 11 to 14 per cent. of moisture and 1 to 2 per cent. of ash. E. P. J.

[2] One egg contains approximately protein 6 grams and fat 6 grams, of which one-half the protein and all the fat are in the yolk. E. P. J.

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FLOUR, MEALS, BREAD, PASTRY, ETC.

	Protein, per cent.	Fat, per cent.	Carbohydrate, per cent.	Caloric value per 100 grams.
Flours, meals, etc.:				
Barley meal and flour	10.5	2.2	72.8	361
Buckwheat flour	6.4	1.2	77.9	356
Cornmeal, unbolted	8.4	4.7	74.0	381
Hominy	8.3	0.6	79.0	363
Oatmeal	16.1	7.2	67.5	409
Rolled oats	16.7	7.3	66.2	407
Rice	8.0	0.3	79.0	359
Rice, boiled	2.8	0.1	24.4	112
Rye flour	6.8	0.9	78.7	359
Wheat flour, California fine	7.9	1.4	76.4	358
Wheat flour, entire wheat	13.8	1.9	71.9	369
Wheat flour, patent roller process, high grade (average of all analyses of high medium grades and grade not indicated)	11.4	1.0	75.1	363
Wheat preparations:				
Macaroni	13.4	0.9	74.1	366
Macaroni, cooked	3.0	1.5	15.8	91
Soy bean meal	42.5	19.9	34.0[1]	499
Pea flour	25.7	1.8	57.0	354
Acorn meal	7.3	4.9	64.0	338
Graham flour	13.3	2.2	70.0	362
Pop corn, popped	10.7	5.0	77.0	586
Cassava meal	1.3	1.2	81.0	348
Potato starch	0.9	0.1	81.0	337
Sago starch	2.2	0.0	81.0	341
Tapioca (Arrow-root)	0.1	0.1	84.0	346
Banana flour	3.9	1.0	85.0	375
Corn starch	1.2	0.0	85.0	353
Rye	10.2	1.7	72.0	353
Buckwheat	10.1	2.5	61.0	315
"Ralston Health Food"	11.9	1.7	72.0	360
"Quaker Wheat Berries"	13.8	1.9	72.0	370
"Wheatlet"	12.8	1.6	74.0	371
"Force"	10.6	1.1	74.0	358
Cracked wheat	11.1	1.7	74.0	365
"Pettijohn's Breakfast Food"	9.1	2.0	74.0	359
"Malt Breakfast Food"	13.8	1.5	75.0	378
"Cream of Wheat"	11.5	0.9	75.0	353
"Triscuit"	11.0	1.4	75.0	365
"Grape Nuts"	11.5	0.6	75.0	360
Farina	11.0	1.4	75.0	367
"Wheatena"	11.3	2.8	76.0	384
"Mapl-Flake"	11.0	1.4	76.0	369
"Shredded Wheat Biscuit"[2]	8.3	0.6	76.0	351
Hominy	7.6	0.2	78.0	353
Puffed rice	6.7	0.4	80.0	359
Toasted corn flakes	..	..	81.0	332

[1] The assimilable carbohydrate in soy beans is 3 per cent. or less.

[2] Weight of 1 biscuit 30 grams, and it contains approximately, carbohydrate 23 grams and protein 3 grams.

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		Protein, per cent.	Fat, per cent.	Carbohydrate per cent.	Starch, per cent.	Caloric value per 100 grams.
[1]1913	Glidine: Menley & James, New York	91.4	0.8	1.0	0	377
1909	Plasmon: Plasmon Co., London	78.7	2.7	0.0	..	339
1915	Cotton-seed flour: Allison, Schulenburg Oil Mill, Schulenburg, Texas	50.4	11.2	..	1.1	348

	Protein, per cent.	Fat, per cent.	Carbohydrate, per cent.	Caloric value per 100 grams.
Bread:				
Bread, brown	5.4	1.8	47.1	231
Bread, corn (Johnnycake)	7.9	4.7	46.3	265
Bread, rye	9.0	0.6	53.2	260
Graham bread	8.9	1.8	52.1	266
Rolls, French	8.5	2.5	55.7	286
Rolls, all analyses	8.9	4.1	56.7	307
Toasted bread	11.5	1.6	61.2	312
White bread, home-made	9.1	1.6	53.3	270
White bread, miscellaneous	9.3	1.2	52.7	266
Whole wheat bread	9.7	0.9	49.0	249
Whole rye bread	11.9	0.6	35.0	198
Peanut bread	33.6	12.8	20.0	339
Acorn bread	..	..	27.0	111
Cassava bread	..	..	27.0	111
Alfalfa bread	10.6	1.3	64.0	318
Crackers:				
Boston (split) crackers	11.0	8.5	71.1	415
Uneeda biscuit[2]	10.1	8.8	70.0	399
Graham crackers	10.0	9.4	73.8	430
Pilot bread	11.1	5.0	74.2	396
Saltines	10.6	12.7	68.5	441
Zwieback	9.8	9.9	73.5	433
Peanut zwieback	23.2	8.0	28.0	284
Doughnuts (range 45.0–63.0)	6.7	21.0	52.0	436
Cake (except fruit cake) (range 53.0–78.0)	6.3	9.0	63.0	368
Jumbles (range 52.0–71.0)	7.4	13.5	63.0	418
Fruit cake	5.0	10.9	64.0	384
Macaroons (range 57.0–70.0)	6.5	15.2	64.0	430

[1] Analysis of preparation manufactured at this date.

[2] Analysis from Conn. Exp. Sta. Report, 1914, p. 230. One biscuit weighs 7 grams and contains about 5 grams carbohydrate, 0.7 gram protein and 0.5 gram fat.

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Pie:	Protein, per cent.	Fat, per cent.	Carbohydrate, per cent.	Caloric value per 100 grams.
Apple	3.1	9.8	42.8	279
Custard	4.2	6.3	26.1	183
Squash	4.4	8.4	21.7	185
Mince (range 30.0–44.0)	5.8	12.3	38.0	194

PASTES.

Noodles	13.3	0.8	72.0	357
Vermicelli	10.9	2.0	72.0	358
Spaghetti	12.1	0.4	74.0	353

	ALMOND PASTE.	Protein, per cent.	Fat, per cent.	Carbohydrate per cent.	Starch per cent.	Calculated calories per 100 grams.
1902–3	Chapman, Chicago	13.1	25.5	36.3	11.3	427
1902–3	Henry Heide, New York	12.7	20.0	43.7	small	406
1902–3	Spencer, New York	13.5	26.2	31.6	very small	416

MISCELLANEOUS.	Carbohydrate, per cent.
Plain chocolate	25.0
Cocoa nibs, roasted	28.0
Baking powder (range 0–51.5)	32.0
Cocoa	38.0
Milk chocolate	51.0
Milk cocoa	52.0
Custard powders	59.0
Sweet chocolate	67.0

NON-ALCOHOLIC BEVERAGES.	Carbohydrate, per cent.
Tea (0.5 oz. to 1 pt. water)	0.6
Coffee (1 oz. to 1 pt. water)	0.7
Cocoa (0.5 oz. to 1 pt. water)	1.1
Cider (range 0–13.5)	4.5
Cocoa (0.5 oz. to 1 pt. milk)	6.0
Cream or lemon soda	7.0
Sarsaparilla	7.0
Birch beer	8.0
Ginger ale	8.0
Root beer	9.0

	Protein, per cent.	Fat, per cent.	Carbohydrate, per cent.	Caloric value per 100 grams.
Chocolate	12.9	48.7	30.3	629
Cocoa	21.6	28.9	37.7	510
Cereal coffee infusion (1 part boiled in 20 parts water)	0.2	..	1.4	7

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	So-called Diabetic Preparations.	Protein, per cent.	Fat, per cent.	Carbohydrate, per cent.	Starch, per cent.	Calculated calories per 100 grams.
	Flours and Meals.					
1910	Acme Mills Co., Portland, Ore. .	9.4	1.9	77.4	71.4	364
	Amthor & Co., Halle: Weizen-Protein	84.1	1.4	4.8	..	368
1912	Herman Barker, Somerville, Mass.:					
	Barker's Gluten Food, "A" .	86.9	0.5	3.7	trace	370
1913	Barker's Gluten Food, "B" .	85.1	0.6	7.2	3.7	375
1913	Barker's Gluten Food, "C" .	84.1	0.6	8.6	3.4	377
1914	Battle Creek Sanitarium Co., Battle Creek, Mich., 80 per cent. Gluten Meal . . .	84.0	..	..	5.8	368
1907	Bischof & Co., London: Gluten Flour	79.8	3.6	5.0	..	372
1909	Callard, Stewart & Watt, London: Casoid Flour	82.5	1.6	3.1	0	357
1913	Cereo Co., Tappan, N. Y.: Soy Bean Gruel Flour . . .	43.1	21.4	24.9	trace	465
1913	Farwell & Rhines, Watertown, N. Y.:					
	Gluten Flour	43.1	1.2	46.6	38.1	370
1913	Gluten Flour	46.3	1.1	42.9	32.8	367
1913	Cresco Flour	18.1	1.0	67.4	57.2	351
1913	Special Dietetic Food . . .	27.5	2.8	56.6	40.0	362
1913	Golden Rod Milling Co., Portland, Ore., Acme Special Flour .	15.8	1.4	71.4	57.9	361
1913	O. B. Gilman, Boston, Mass.: Gluten Flour	47.3	2.0	40.4	31.4	369
1908	Hazard's Wheat Protein . . .	41.8	1.2	49.1	..	374
1913	Health Food Co., New York: Almond Meal	50.3	14.8	17.9	trace	406
1914	Almond Meal	49.1	21.8	15.9	0	457
1911	C B X Cold Blast Flour, 25 per cent. protein	10.1	0.9	79.6	68.9	367
1913	Proniren (Griddle-cake Flour) .	37.3	1.2	..	37.7	349
1913	Glutosac Gluten Flour . . .	39.9	2.3	47.5	36.9	370
1914	Gluten Flour No. 1	75.7	0.9	12.8	7.1	362
1913	Protosac Gluten Flour . . .	42.7	1.7	46.4	36.3	372
1913	Protosoy Soy Flour	42.3	19.8	24.5	trace	446
1913	Pure Washed Gluten Flour . .	80.3	1.6	29.5	7.0	380
1914	Gluten Flour	45.9	2.0	42.3	31.5	370
1914	Protosoy Soy Flour	42.9	19.2	26.0	1.9	448
1914	Pure Washed Gluten . . .	85.6	1.0	5.4	2.8	373
1906	Jireh Diabetic Food Co., New York:					
1906	Diabetic Flour	14.3	2.2	71.9	66.6[1]	365

[1] Determined by the diastase method, without previous washing with water, and calculated as starch.

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	So-called Diabetic Preparations.	Protein, per cent.	Fat, per cent.	Carbohydrate, per cent.	Starch, per cent.	Calculated calories per 100 grams.
	Flours and Meals.—Continued.					
	Jireh Diabetic Food Co., New York:					
1906	Diabetic Flour	12.1	1.8	72.7	..	355
1913	Flour	14.4	2.3	72.9	60.9	370
1913	Patent Barley	11.4	1.6	80.2	67.8	381
1913	Patent Cotton Seed Flour . .	49.4	12.7	21.3	6.0	396
1913	Patent Lentils Flour . . .	27.3	1.2	59.8	42.6	359
1913	Protein Flour	31.4	2.0	56.7	48.5	370
1913	Soja Bean Flour	42.3	18.2	25.8	0.0	435
1913	Wheat and Barley Flour . .	11.8	1.9	73.5	66.2[1]	358
1911	Johnson Educator Food Co., Boston, Mass.:					
	Educator Standard Gluten Flour	40.1	1.4	50.2	40.9	374
1912	The Kellogg Food Co., Battle Creek, Mich.:					
	20 per cent. Gluten Meal . .	27.5	0.5	71.7	49.6	357
1913	40 per cent. Gluten Flour . .	43.7	0.9	47.3	40.5	367
1912	80 per cent. Gluten	81.3	0.9	..	6.2	365
1913	Eugene Loeb, New York:					
	Gluten Cracker Meal . . .	27.8	7.7	53.5	40.2	394
1913	Imported Gluten Flour . . .	76.3	0.9	11.8	4.4	361
1913	Pure Gluten Flour	40.3	2.4	46.3	39.6	368
1913	Whole Wheat Flour	14.6	2.2	70.5	54.6	360
1913	Gluten Flour	43.9	1.1	44.4	39.8	363
1915	Lister Bros., New York:					
	Diabetic Flour	84.5	3.6	..	0	372
1913	Thos. Martindale & Co., Phila.:					
	Special Gluten Flour . . .	40.3	1.5	49.1	41.4	371
1913	Mayflower Mills, Ft. Wayne, Ind.:					
	Bond's Diabetic Flour . . .	40.2	1.3	48.3	40.6	366
1913	Theo. Metcalf Co., Boston, Mass.:					
	Soja Bean Meal, 18 per cent. starch	41.0	20.0	25.0	..	444
1913	Vegetable Gluten, 8.1 per cent. starch	80.4	1.5	9.8	5.9	374
1913	Pieser Livingston Co., Chicago:					
	Gluten Flour	43.3	1.3	46.2	38.4	370
1911	Pure Gluten Food Co., New York:					
	Gum Gluten Flour	38.3	1.6	50.8	42.4	371
1906	Gum Gluten Ground . . .	50.1	1.9	39.6	38.6[2]	376
1906	Hoyt's Gum Gluten . . .	31.8	1.6	..	52.0[2]	358
1914	Hoyt's Gum Gluten Biscuit Crisps	52.7	0.5	38.0	31.2	368

[1] Possibly in part due to the copper-reducing power of the agar agar present.
[2] Determined by the diastase, etc. (see preceding page).

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	So-called Diabetic Preparations.	Protein, per cent.	Fat, per cent.	Carbohydrate, per cent.	Starch, per cent.	Calculated calories per 100 grams.
	Flours and Meals.—Continued.					
	Pure Gluten Food Co., New York:					
1914	Breakfast Food	45.4	0.9	46.4	39.2	375
1914	Flour, 50 per cent.	49.7	1.2	41.5	37.1	375
1914	Flour, Ground	41.9	0.9	48.1	42.6	369
1914	Granules	42.7	0.7	48.8	41.9	372
1914	Noodles	40.5	1.2	49.1	41.8	369
1914	Self-raising Flour	42.7	0.8	45.0	39.0	357
1914	Special Flour	90.7	0.7	1.7	2.2	376
1914	No. 1 Dainty Fluffs	79.9	0.5	11.3	10.7	370
1914	No. 2 Dainty Fluffs	66.3	0.5	24.9	21.9	369
1913	Sprague, Warner & Co., Chicago: Richelieu Gluten Flour	47.7	1.2	39.7	31.6	368
1913	G. Van Abbott & Sons, London: Almond Flour	24.6	58.6	7.9	0.0	657
1913	Gluten Flour	75.1	0.9	12.6	12.4	359
1913	Wilson Bros., Rochester, N. Y.: Gluten Flour, ½ Standard	20.8	2.1	64.6	54.6	361
1913	Self-raising, ½ Standard	17.4	2.0	63.5	51.8	342
1913	Waukesha Health Products Co., Waukesha, Wisc.: Hepco Flour	42.9[1]	20.8	22.3[2]	trace	448
	Breakfast Foods.					
1913	Brusson Jeune, Villemur, France: Farine au Gluten	33.9	0.6	53.8	48.8	356
1910	Gluten Semolina	17.2	0.5	71.6	64.9	360
1913	Farwell & Rhines, Watertown, N. Y.: Barley Crystals	11.5	1.3	75.2	62.7	359
1913	Cresco Grits	17.8	1.4	68.6	54.1	358
1908	Hazard's Wheat Protein Breakfast Food	40.1	1.0	49.7	..	368
1913	Health Food Co., New York: Manana	37.6	1.9	46.8	31.0	355
1913	Jireh Diabetic Food Co., New York: Whole Wheat Farina	12.9	2.3	74.6	59.5	371
1913	Frumenty	12.3	1.7	77.3	65.4	374
1911	The Kellogg Food Co., Battle Creek, Mich.: Granola	13.9	0.8	76.3	45.2	368

[1] Determined by the diastase method, without previous washing with water, and calculated as starch.

[2] Chiefly derived from Soy bean and therefore non-assimilable, and for patients can be considered carbohydrate-free.

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	So-called Diabetic Preparations.	Protein, per cent.	Fat, per cent.	Carbohydrate, per cent.	Starch, per cent.	Calculated calories per 100 grams.
	Breakfast Foods.—Continued.					
1911	Pure Gluten Food Co., New York: Gum Gluten Breakfast Food .	37.8.	1.3	51.8	37.9	370
1911	Gum Gluten Granules . . .	45.5	1.6	43.6	32.3	371
1901	Pure Gluten Breakfast Cereal .	43.7	1.6	44.4	..	367
	Waukesha Health Products Co., Waukesha, Wis.: Hepco Grits[1]					
	Macaroni, Noodles, etc.					
1906	Pure Gluten Food Co., New York: Gum Gluten Macaroni . . .	41.4	1.0	46.3	46.2[2]	360
1911	Gum Gluten Noodles . . .	36.6	2.4	51.4	42.0	374
1910	Brusson Jeune, Villemur, France: Pâtes aux Oeufs Macaroni . .	13.9	0.4	76.2	69.2	364
1910	Pâtes aux Oeufs Nouillettes .	14.4	0.5	75.7	68.9	365
1913	Petites Pâtes au Gluten . .	18.6	1.0	70.4	61.2	365
1910	Vermicelle au Gluten . . .	18.4	0.4	72.4	65.8	367
1913	Jireh Diabetic Food Co., New York: Macaroni	16.9	0.9	71.4	58.8	361
1913	Eugene Loeb, New York: Home-made Noodles	41.8	5.5	41.7	36.7	384
1913	Gustav Müller & Co., New York: Dr. Bouma Sugar-free Fat-milk[3]	2.4	5.3	..	..	57
1913	D. Whiting & Sons, Boston: Sugar-free Milk (ave. 3 analyses)	5.7	7.2	trace	..	88
	Soft Breads.					
1913	Ferguson Bakery, Boston, Mass.: Gluten Bread	24.2	3.1	33.6	25.2	259
1906	Health Food Co., New York: Glutosac Bread	27.4	2.7	36.1	29.9[1]	278
1914	Glutosac Bread	27.2	2.1	31.1	22.2	
1906	Health Food Co.: Protosac Bread	32.5	..	37.0	1.6	292
1914	Protosac Bread	29.8	1.8	35.2	27.7	276
1914	J. Heinbockel & Co., Baltimore, Md.: Diabetic Bread for Diabetes .	8.6	1.5	52.1	40.4	256
1906	Jireh Diabetic Food Co., New York: Whole Wheat Bread . . .	9.4	48.6	..	0.4	236

[1] Said to be identical with Waukesha Hepco Dodgers.
[2] Determined by the diastase, etc. (see preceding page).
[3] Water 91.8 per cent.

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	So-called Diabetic Preparations.	Protein, per cent.	Fat, per cent.	Carbohydrate, per cent.	Starch, per cent.	Calculated calories per 100 grams.
	Soft Breads.—Continued.					
1913	Eugene Loeb, New York:					
	P. & L. Genuine Gluten Bread	10.4	2.6	53.7	44.2	280
1914	P. & L. Genuine Glubëtic Bread	38.8	4.1	25.7	19.2	294
1915	Lister Bros., New York:					
	Casein Bread	36.6	18.4	..	0	322
	Hard Breads and Bakery Products.					
1907	Bischof & Co., London:					
	Diabetic Gluten Bread . . .	73.1	0.5	14.3	..	354
1907	Essential Bread for Super-Alimentation	26.6	1.6	59.6	..	359
1912	Brusson Jeune, Villemue, France:					
	Gluten Bread	37.3	1.8	47.1	40.1	354
1909	Callard, Stewart & Watt, London:					
	Almond Biscuit, plain	28.3	28.0	36.8	..	512
1909	Almond Shortbreads . . .	19.5	52.1	27.0	..	630
1913	Casoid Biscuits, No. 1 . . .	66.8	18.8	5.8	4.0	460
1909	Casoid Biscuits, No. 2 . . .	57.8	25.5	5.6	0.0	483
1909	Casoid Biscuits, No. 3 . . .	54.3	25.0	7.8	trace	473
1909	Casoid Dinner Rolls . . .	78.0	11.1	2.1	..	420
1909	Casoid Lunch Biscuit . . .	25.5	44.9	21.6	..	593
1909	Casoid Rusks	37.0	32.3	20.8	..	522
1909	Cocoanut Biscuit + Saccharin	16.6	61.3	16.4	..	684
1909	Ginger Biscuit + Saccharin .	17.1	58.6	18.1	..	668
1913	Kalari Batons	43.2	39.0	7.4	0	553
1909	Kalari Biscuits	56.9	31.4	1.7	..	517
1909	Prolactic Biscuit	42.9	27.5	19.3	..	496
1913	Charrasse Biscuits Croquettes au Gluten	34.3	5.4	52.3	30.6	395
1913	Biscottes Lucullus	11.4	5.7	73.4	59.2	391
1913	Gluten Exquis Biscuits aux Amandes	18.1	23.8	15.6	25.5	489
1913	Gluten Fleur de Neige Pain .	35.9	12.5	42.8	25.1	427
1913	Mignonettes au Gluten . . .	40.1	5.7	43.6	27.3	386
1913	Pain de Gluten	40.8	5.3	43.5	27.2	385
1913	Tranches Grillées pour Potage	40.6	3.6	45.5	28.8	377
1913	Health Food Co., New York:					
	Alpha Best Diabetic Wafer .	66.1	13.6	11.3	trace	432
1914	Alpha Best Diabetic Wafer .	67.1	8.4	11.7	1.3	391
1913	Diabetic Biscuit	25.0	9.2	54.2	46.5	400
1914	Diabetic Biscuit	35.9	8.8	46.5	39.8	409
1913	Gluten Nuggets	30.2	12.8	48.3	38.6	429

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	So-called Diabetic Preparations.	Protein, per cent.	Fat, per cent.	Carbohydrate, per cent.	Starch, per cent.	Calculated calories per 100 grams.
	Hard Breads, etc.—Continued.					
	Health Food Co., New York:					
1906	Glutona	22.1	11.8	58.5	54.9[1]	429
1906	Glutosac Butter Wafers	27.6	12.9	49.4	41.2[1]	424
1906	Glutosac Rusks	36.5	3.8	51.6	42.5[1]	387
1906	Wafers, Plain	29.4	9.6	49.9	41.6[1]	404
1906	Zwieback	32.5	6.9	49.3	40.9[1]	389
1913	No. 1 Proto Puffs	76.3	2.9	10.7	4.3	374
1913	No. 2 Proto Puffs	56.6	2.1	30.7	19.0	368
1906	Protosac Rusks	40.9	2.0	48.7	43.9[1]	376
1913	Protosoy Diabetic Wafers	43.1	24.9	21.2	4.7	481
1906	Salvia Sticks	39.2	20.8	2.4	18.7[1]	440
1914	Gluten Nuggets	31.7	14.3	45.7	34.9	438
1914	Gluten Butter Wafers	31.1	13.9	47.0	38.9	438
1914	Gluten Rusks	39.3	3.4	47.0	33.6	376
1914	Gluten Wafers, Plain	42.6	1.7	44.3	29.6	363
	Gluten Zwieback	36.4	7.7	46.6	32.5	401
1914	Manana Gluten Breakfast Food	42.6	2.0	43.6	29.9	363
1914	No. 1 Proto Puffs	72.3	2.8	13.0	9.2	366
1914	No. 2 Proto Puffs	58.8	2.1	27.0	20.7	362
1914	Protosac Rusks	39.7	3.0	46.7	35.9	373
1914	Protosoy Diabetic Wafers	37.1	23.5	29.3	14.4	477
1914	Salvia Almond Sticks	22.3	29.9	41.0	28.3	523
1913	Heinz Food Co., Chicago:					
	Gluten Biscuits	12.8	18.3	57.7	21.4	447
1914	Heudebert, Paris:					
	Pain d'Aleurone pour Diabétiques	76.1	1.5	9.2	4.2	354
1914	Pain de Gluten pour Diabétiques	80.7	0.8	6.5	3.4	356
1914	Pain de "Essential" en Biscottes	26.4	1.2	62.2	49.9	365
1906	Jireh Diabetic Food Co., New York:					
	Diabetic Biscuits	14.8	3.7	72.3	65.4[1]	382
1906	Diabetic Rusks	14.6	5.0	67.7	..	374
1913	Diatetic Biscuits	13.2	7.4	70.8	49.6	403
1913	Diatetic Rusks	14.9	8.7	68.0	47.0	410
1906	Wheat Nuts	19.0	15.6	54.5	50.1[1]	434
1906	Johnson Educator Food Co., Boston:					
	Almond Biscuits	29.0	8.8	54.3	50.0[1]	412
1906	Diabetic Biscuits	25.3	7.5	59.0	54.9[1]	405
1906	Educator Crackers, Greseni Gluten	23.0	4.6	63.1	57.9[1]	386

[1] Determined by the diastase method, without previous washing with water, and calculated as starch.

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	So-called Diabetic Preparations.	Protein per cent.	Fat, per cent.	Carbohydrate, per cent.	Starch, per cent.	Calculated calories per 100 grams.
	Hard Breads, etc.—Continued.					
	Johnson Educator Food Co., Boston:					
1913	Educator Gluten Bread Sticks	35.9	7.2	45.8	37.5	392
1911	Gluten Cookies	26.4	16.0	49.8	37.8	449
1906	Gluten Rusk, Greseni Gluten	22.1	0.3	68.1	63.3[1]	364
1906	Gluten Wafers	30.3	0.4	61.2	57.0[1]	370
1906	Glutine, Greseni Gluten	21.9	0.8	67.7	63.1[1]	366
1912	The Kellogg Food Co., Battle Creek, Mich.:					
	Avena-Gluten Biscuit	21.4	12.7	55.5	41.1	422
1913	Potato Gluten Biscuit	41.5	0.5	48.0	39.5	363
1909	Pure Gluten Biscuit	48.3	3.3	39.1	..	379
1913	Taro-Gluten Biscuit	31.3	0.5	57.7	48.2	361
1913	40 per cent. Gluten Biscuit	37.2	0.8	53.2	45.0	369
1912	80 per cent. Gluten Biscuit	82.4	0.9	4.4	4.7	355
1913	Eugene Loeb, New York:					
	Gluten Luft Bread	27.9	9.2	54.2	44.1	411
1914	Gluten Luft Bread	52.4	13.2	26.0	22.9	433
1914	Chocolate Almond Bars	16.3	41.0	31.8	5.7	561
1914	Diabetic Almond Macaroons	46.5	37.7	8.0	0.6	558
1914	Diabetic Bread Sticks	50.4	3.4	34.5	24.6	371
1914	Diabetic Chocolates	14.9	51.4	23.0	6.9	614
1914	Diabetic Lady Fingers	56.6	28.3	6.0	1.8	505
1914	Diabetic Sponge Cookies	54.7	30.1	5.0	1.2	510
1913	Pure Gluten Food Co., New York:					
	Gum Gluten Biscuit Crisps	42.9	0.7	48.5	39.3	372
1913	G. Van Abbott & Sons, London:					
	Caraway Biscuits for Diabetics	35.6	37.5	15.9	8.6	544
1913	Diabetic Rusks for Diabetics	70.9	0.8	16.0	12.6	355
1913	Euthenia Biscuits	35.8	40.7	13.2	6.9	562
1913	Gluten Biscottes or Rolls	51.6	2.3	33.0	29.8	359
1913	Gluten Bread or Slices	54.1	2.2	30.9	27.4	361
1913	Gluten Butter Biscuits for Diabetics	44.1	33.2	12.7	9.0	526
1913	Ginger Biscuits for Diabetics	34.6	39.4	16.7	10.9	560
1913	Midolia Biscuits	17.6	36.4	31.6	13.4	524
1913	Walnut Biscuits for Diabetics	20.9	57.2	12.3	trace	648
1913	Waukesha Health Products Co., Waukesha, Wis.: Hepco Dodgers	41.6	21.3	20.7	trace	441
1913	Callard, Stewart & Watt, London Casoid Chocolate Almonds	22.3	51.8	16.1	trace	620

[1] Determined by the diastase method, without previous washing with water, and calculated as starch.

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Wines:[1] Dry.

		Grams reducing sugars, per 100 c.c.
California, red, Bordeaux or Claret	(range 0.04– 0.63)	0.16
" " Burgundy	(range 0.03– 0.42)	0.15
" " Zinfandel	(range 0.03– 0.35)	0.15
" white, Rhine	(range 0.06– 0.63)	0.15
" " Burgundy	(range 0.10– 0.45)	0.23
" " Sauterne	(range 0.07– 3.57)	0.64
French, red	(range 0.11– 0.84)	0.23
" white	(range 0.65– 1.02)	0.84
German, white	(range 0.09– 1.96)	0.20
Hungarian, white	(range 0.04– 0.86)	0.25
Italian, red	(range 0.02– 2.70)	0.16
" white	(range 0.02– 2.15)	0.19
North Carolina	(range 0.08– 1.75)	0.49
Ohio	(range 0.07– 1.54)	0.31
Portuguese, red	(range 0.01– 1.21)	0.16
" white	(range 0.10– 1.19)	0.32
Rhine, red	(range 0.06– 0.27)	0.13
" white	(range 0.02– 1.02)	0.18
Spanish, red	(range 0.19– 0.54)	0.35
" white	(range 0.27– 0.62)	0.42
Sparking, French and German	(range 0.13– 1.95)	0.53
Swiss, red	(range 0.10– 0.27)	0.13
" white	(range 0.08– 0.38)	0.10
Virginia	(range 0.06– 1.23)	0.16

Wines: Sweet.

California Port	(range 0.23–13.56)	4.76
" Madeira and Sherry	(range 0.12–17.21)	5.38
French	(range 0.73–12.40)	5.38
German	(range 0.64–12.13)	4.60
Madeira	(range 2.48– 3.88)	2.95
Malaga	(range 12.50–25.20)	18.32
Marsala	(range 2.67– 8.24)	3.25
Port	(range 3.76– 8.17)	6.04
Rhine	(range 1.82–10.69)	6.35
Sherry	(range 0.52– 4.80)	2.54
Sparkling, American	(range 6.51–12.02)	8.28
" French and German	(range 8.00–18.50)	10.92
Tokay, true	(range 1.86–20.50)	12.62
" commercial	(range 2.70–40.70)	19.80
Vermouth	(range 3.47–14.39)	9.46

[1] Wines contain approximately 10 per cent. alcohol.

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WINES: ESPECIALLY LOW IN CARBOHYDRATE.

MANUFACTURER OR AGENT AND BRAND.	Alcohol by volume per cent.	Carbohydrate, per cent.[1]
Alfonso & Hipolito:		
Sancho Vinos de Jerez Amontillado Don Quixote (Wm. J. Sheehan Co., New Haven, Agents)	20.60	1.23
Brotherhood Wine Co., New York City:		
Sunnyside Claret	11.87	0.16
Riesling	12.37	0.34
Vin-Crest Brut	12.24	1.66
California Wine Association, New York City:		
Riesling	11.31	0.10
Zinfandel	11.62	0.16
Calwa Distributing Co., New York City:[2]		
"Calwa" Brand Greystone (Light Hock Type)[2]	11.81	0.19
"Calwa" Brand La Loma (Burgundy Type)[2]	11.27	0.14
"Calwa" Brand Vine Cliff (Riesling)[2]	10.90	0.17
"Calwa" Brand Winehaven (Table Claret)[2]	11.46	0.14
H. T. Dewey & Sons Co., New York City:		
Ives Claret	12.53	0.24
Moselle Type	8.37	0.14
Old Burgundy Type	11.14	0.27
Ruby Claret	13.03	0.27
Pedro Domecq's Manzanilla Sherry[3]	20.86	0.32
Empire State Wine Co., Penn Yan, N. Y.:		
Dry Catawba	12.80	0.15
State Seal Champagne	12.39	1.51
Los Angeles Co., Boston, Mass:		
California Chasselas	12.12	2.97
California Chasselas	11.68	2.99
California Gutedel	11.87	0.79
California Gutedel	11.56	0.19
Monticello Wine Co., Charlottesville, Va.:		
Extra V. Claret	12.80	0.25
Norton's Virginia	12.57	0.37
Virginia Claret	12.54	0.20
Virginia Hock	12.60	0.22
A. Pierlot & Co., Bouzy, Rheims:		
Champagne Vin Nature sans Sucre	11.97	0.36
Pleasant Valley Wine Co., Rheims, N. Y.:		
Claret	11.22	0.29
Dry Catawba	12.02	0.18
Great Western Extra Dry	12.33	4.36
William J. Sheehan Co., New Haven, Agents:		
California Cabernet	11.49	0.31
California Hock	11.21	0.14
California Riesling	11.15	0.14
California Zinfandel	11.32	0.16
Urbana Wine Co., Urbana, N. Y.:		
Gold Seal Brut	12.14	2.30
Gold Seal Absolutely Dry	12.65	0.54
Gold Sparkling Red, Special Dry	11.26	2.86
Gold Sparkling Red, Absolutely Dry	11.98	0.29

[1] Grams reducing sugars per 100 c.c.
[2] Sold by M. Zunder & Sons, New Haven, Conn.
[3] Sold by Chris. Xander, Washington, D. C.

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Other Alcoholic Beverages.

Brandy, gin, rum, whisky	0[1]
Absinth	Trace
Angostura	4.2
Beer	4.5
Weiss bier	4.6
Ale	5.1
Porter or Stout	7.0
Malt extract, commercial	10.6
Curaçao	25.5
Crême de menthe	27.7
Kümmel	31.2
Benedictine	32.6
Anisette	34.4
Chartreuse	34.4
Maraschino	52.3
Malt extract, true	71.3

[1] Grams reducing sugars per 100 c.c.

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PART IV.

SELECTED LABORATORY TESTS USEFUL IN MODERN DIABETIC TREATMENT.

CHAPTER I.

THE EXAMINATION OF THE URINE, BLOOD AND EXPIRED AIR.

An early diagnosis in diabetes is as important as in tuberculosis. The disease usually begins insidiously, and its prompt detection depends upon the routine examination of the urine of all patients rather than upon the examination of the urines of patients who present symptoms of the disease. General practitioners should teach their patients, as a matter of routine, to have their own urines and those in their families examined each birthday. This is not fantastic. It is simply a part of the movement to have each member of the community undergo a physical examination each year.

EXAMINATION OF THE URINE

Examination of the urine should cost the patient little. Formerly I deprecated the routine examinations made in drug stores, but now I welcome them. The druggist is a trained chemist. He is constantly doing quantitative work, and it is far easier and cheaper for him to examine a urine than for a doctor. Druggists will undoubtedly undertake such work with satisfaction. It will be an agreeable relief from the many activities in a drug store which have nothing to do with the profession of a pharmacologist.

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The examination of the urine of the diabetic patient is usually a simple matter. It comprises a statement indicating the volume in twenty-four hours, specific gravity, reaction, presence or absence of albumin, sugar and diacetic acid. Frequently the ammonia, salt (sodium chloride), acetone and nitrogen are determined and the urinary sediment submitted to microscope study.

Although diabetic patients can test their own urines for sugar and almost invariably are warranted in relying upon the result of their examination, they should not feel that they are expert analysts. More than once patients have arrived at erroneous conclusions, in part due to the preparation of chemical reagents employed. I believe it is therefore safer for all diabetic patients to send their urines once a month to their physician, for the simple tests for volume, color, reaction, specific gravity, albumin and sugar. Such an examination can be made by a physician within fifteen minutes. A quantitative examination for sugar would require an individual, not daily accustomed to it, not far from half an hour or more.

The Collection of the Twenty-four-hour Quantity of Urine.—To collect the twenty-four-hour quantity of urine, discard that voided at 7 A.M. and then save in a cool place all urine passed thereafter up to and including that obtained at 7 A.M. the next morning.

Reaction.—The normal urine is acid. Urine voided after a meal rich in vegetables and fruits is frequently alkaline, due to the alkaline salts which they contain. Therefore the report that the urine is acid does not imply in the slightest degree that a patient has acid poisoning. (For detection of acid poisoning, see Tests for Diacetic Acid and Ammonia, pp. 176 and 177.)

Specific Gravity.—The specific gravity of the urine will be best understood if it is recalled that the specific gravity of water is considered to be 1000. Normal urine has a specific gravity, on account of the solids contained in it, of about 1015 to 1020. Normal urine if concentrated would have a higher specific gravity, and if dilute it would be lower. The specific gravity of the urine in diabetes varies chiefly with the percentage of sugar which it contains. It frequently is

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above 1020 and may be above 1040, but I have known sugar to be present in the urine when the specific gravity was as low as 1007.

Albumin.—Two tests are usually employed, the one in confirmation of the other.

1. *Nitric Acid Test.*—To 5 c.c. of filtered urine add one-third the quantity of nitric acid by pouring it down the side of the glass so that it underlies the urine. A white precipitate forms in the urine at the junction of the two fluids. A precipitate higher in the urine may be due to urates. Bile or urinary coloring matters may give a color to the urine or precipitate at the junction of the fluids.

2. *Heat Test.*—Pour 10 c.c. of filtered urine into a test-tube and boil the upper half of the fluid. Add one or two drops (not more) of ordinary (36 per cent.) acetic acid and boil again. A precipitate appearing on boiling which persists after the addition of the acid, or appearing on the second boiling, is albumin; one disappearing with the acid is phosphates. The test may fail with an excess of acid.

Sugar.—Sugar is absent from the urine of carefully treated diabetics. If present it can be readily demonstrated if it amounts to as little as 0.05 per cent., and it may rise to as high as 9 or 10 per cent. when the diabetic diet is not followed. Most untreated cases show between 2 and 6 per cent. of sugar. The total quantity of sugar in the urine in the twenty-four hours is easily estimated by multiplying the percentage of sugar which the urine contains by the total amount of urine voided. Thus, if the total quantity of urine is 3 liters (3000 c.c., a little more than 3 quarts, which would equal 2838 c.c.), and the percentage of sugar is 4, the amount of sugar in the urine would be (3000×0.04) 120 grams, that is, about 4 ounces or $\frac{1}{4}$ pound. It is not very often that one finds more than 1 pound of sugar excreted in the urine during twenty-four hours. The food value of the sugar lost, if only 120 grams, is considerable. Each gram of sugar is the equivalent of 4 calories, and the total would amount to 480 calories in a day, which is approximately one-fourth of the total food value required by an individual, with a quiet occupation, who weighs 60 kilograms (132 pounds). Thus it is

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evident that 4 untreated diabetics, even though the disease is of very moderate severity, provided they eat enough to make up the loss, will waste in a day enough food to supply the needs of a normal individual of equal weight for the same space of time.

Tests for Sugar.—*Qualitative Tests.*—Many tests for sugar in the urine are employed. At present I use the Benedict test[1] most. The Benedict solution employed has the advantage of not decomposing even after months. Druggists occasionally find difficulty in making it, and on three occasions my patients have been sold unreliable solutions. The qualitative Benedict solution is made as follows:

	Grams or c.c.
Copper sulphate (pure crystallized)	17.3
Sodium or potassium citrate	173.0
Sodium carbonate (crystallized) (one-half the weight of the anhydrous salt may be used)	200.0
Distilled water to make	1000.0

The citrate and carbonate are dissolved together (with the aid of heat) in about 700 c.c. of water. The mixture is then poured (through a filter if necessary) into a larger beaker or casserole. The copper sulphate (which should be dissolved separately in about 100 c.c. of water) is then poured slowly into the first solution, with constant stirring. The mixture is then cooled and diluted to one liter. This solution keeps indefinitely.

Case No. 632 has written out the rules for the test, with his customary military directness and precision:

Benedict's solution is used for testing the urine for sugar as follows: To about 5 c.c. (one large teaspoonful) of the solution add 8 drops of urine; the test may then be continued in either of the two following ways:

1. Boil the mixture of the solution and urine for three minutes and set aside to cool to the temperature of the room.

2. Place the tube containing the mixture of the solution and urine in bubbling, boiling water, where it must remain, with the water actually boiling, for five minutes.

In either case if the solution remains clear the urine being tested is sugar-free; if a heavy greenish precipitate forms it

[1] Benedict, S. R.: Jour. Am. Med. Assn., 1911, lvii, p. 1193.

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usually means there is a trace of sugar; the appearance of a yellow sediment indicates the presence of a few tenths per cent. of sugar in the urine, and a red sediment more.

Benedict's original description of the test is as follows: Five cubic centimeters, a trifle over one teaspoonful, of the Benedict solution, are placed in a test-tube and 8 to 10 drops (not more) of the urine to be examined are added. The mixture is then heated to vigorous boiling, kept at this temperature for three minutes, and allowed to cool spontaneously. In the presence of glucose the entire body of the solution will be filled with a precipitate, which may be greenish, yellow or red in tinge according to whether the amount of sugar is slight or considerable. If the quantity of glucose be low (under 0.3 per cent.) the precipitate forms only on cooling. If no sugar be present, the solution either remains perfectly clear, or shows a faint turbidity that is blue in color, and consists of precipitated urates. The chief points to be remembered in the use of the reagent are (1) the addition of a small quantity of urine (8 to 10 drops) to 5 c.c. of the reagent, this being desired not because larger amounts of normal urine would cause reduction of the reagent, but because more delicate results are obtained by this procedure; (2) vigorous boiling of the solution after addition of the urine, and then allowing the mixture to cool spontaneously, and (3) if sugar be present the solution (either before or after cooling) will be filled from top to bottom with a precipitate, so that the mixture becomes opaque.

Benedict (personal communication) states that the test as performed above will detect glucose in as low concentration as 0.01 to 0.02 per cent. provided the urine is of low dilution.

Fehling's Test.—The solutions required are made up as follows: Dissolve 34.64 gm. pure $CuSO_4$ in water and make up to 500 c.c. Dissolve 173 gm. Rochelle salt and 60 gm. sodium hydrate each in 200 c.c. water and mix, and then make up also to 500 c.c.; 5 c.c. of each solution are used for the test.

In performing the test, 3 to 5 c.c. of equal quantities of the copper solution and the alkaline solution are mixed in a test-tube and thoroughly boiled. If no reduction takes place one-half as much urine as the reagent employed is then added

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and the whole boiled vigorously again. A yellow or red precipitate indicates the presence of sugar; a greenish precipitate may or may not indicate sugar. Occasionally substances in the urine other than sugar reduce the copper upon prolonged boiling, but this is so exceptional that I consider it far safer to boil the solution a second time, and when in doubt, to repeat the test without boiling.

Quantitative Tests.—All quantitative tests for glucose in the urine are as unsatisfactory as the qualitative tests are satisfactory. It is one of the chief advantages of modern treatment that the need for these tests is nearly abolished. It will be one of the disadvantages of modern treatment if we introduce a multiplicity of new tests in diabetes. The simplification of the treatment of diabetes means everything to the practitioner and patient. The simplest quantitative test for sugar for physicians who do not devote unusual attention to diabetes is the fermentation test.

Fermentation Test.—To 100 c.c. of urine of known specific gravity, one-fourth of a fresh yeast cake, thoroughly broken up, is added and the whole is set away at a temperature of 85° to 95° F. Twenty-four hours later the urine is tested with Fehling's or Benedict's solutions. If a reduction is obtained it is set aside for further fermentation. Complete fermentation having been proved, the specific gravity is taken after the urine has acquired its original (room) temperature. The difference in specific gravity multiplied by 0.23 gives the percentage. In the performance of the fermentation test for sugar a few crystals of tartaric acid should be added whenever the urine is alkaline. If the temperature of the urine (room) is 76° F. when the specific gravity is taken at the beginning and end of the test the result will be still more accurate.

Benedict's Test.—The easiest method with which I am acquainted for performing the quantitative Benedict test is that employed by Miss Evelyn Warren, my laboratory assistant.

Quantitative Benedict Solution.

The quantitative Benedict solution is different from the qualitative. Mistakes often occur from this solution being

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used for the qualitative test for sugar, for which purpose it is valueless. The quantitative Benedict solution is given on page 173.

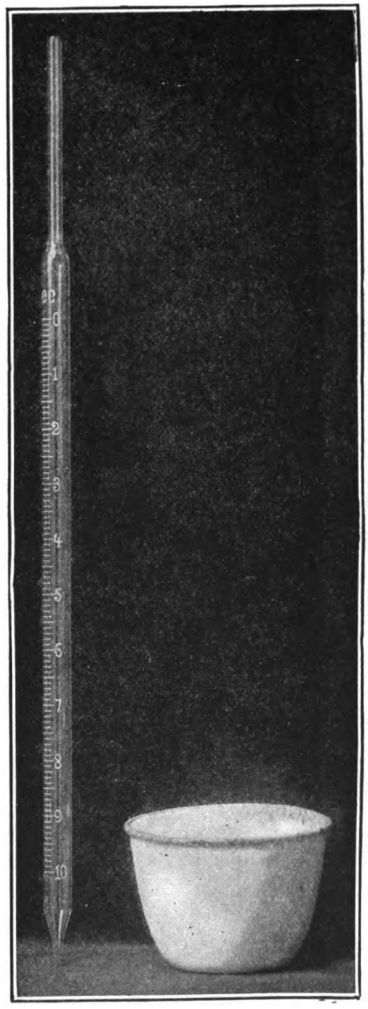

FIG. 16.—Apparatus required for a simplified, quantitative Benedict test.

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Articles Required.

Ten cubic centimeter graduated pipette; small white enamelware dish, 3 inches across, 2 inches deep; sodium carbonate; talcum.

The test can be performed by the aid of a kitchen gas burner. If the gas burner is not a small one and so flares up around the edges of the dish, put an asbestos plate or simply an iron cover over it.

Performance of Test.

1. Place 5 c.c. of the quantitative Benedict solution in the dish.
2. Add less than one-fourth teaspoonful of sodium carbonate.
3. Add one-half as much talcum.
4. Add about 10 c.c. water.
5. Dilute 1 part urine with 9 parts of water unless the quantity of sugar is low. (A low per cent. of sugar is shown by the qualitative Benedict test turning green instead of yellow. With small quantities of sugar, it is unnecessary to dilute the urine.)
6. Bring the contents of the dish to boiling, maintain in this condition and then add, drop by drop, the urine from the graduated pipette until the blue color has entirely disappeared. Upon the first trial too much may be added, and therefore, having noted the approximate quantity of urine required to reach the end-point, invariably repeat the test as a control.

Calculation.

Five cubic centimeters of the Benedict quantitative copper solution are reduced by 0.01 gram glucose. Consequently, the quantity of undiluted urine required to reduce the 5 c.c. Benedict solution contains 0.01 gram glucose.

$$\frac{0.01}{x} \times 100 = \text{per cent.} \qquad x = \text{c.c. of undiluted urine.}$$

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Example.—Fifteen hundred cubic centimeters urine in twenty-four hours. Five cubic centimeters used to reduce (decolorize) the Benedict solution.

$$\frac{0.01}{5} \times 100 = 0.2 \text{ per cent.}$$

1500 × 0.002 (0.2 per cent.) = 3 grams sugar in twenty-four hours.

Example.—If the urine had been diluted with 9 parts water —in other words, 10 times—the calculation would be:

5 c.c. diluted urine = 0.5 c.c. actual urine.

$$\frac{0.01}{0.5} \times 100 = 2 \text{ per cent.}$$

1500 × 0.02 (2 per cent.) = 30 grams sugar in twenty-four hours.

For convenience in the laboratory, instead of working out the percentages of sugar in the urine by the above formula, we use the accompanying scale, shown in Table 32.

The method as originally described by Benedict[1] is as follows: "Like Fehling's quantitative process the method is based on the fact that in alkaline solution a given quantity of glucose reduces a definite amount of copper, thus decolorizing a certain amount of copper solution. The copper is, however, precipitated as cuprous sulphocyanate, a snow-white compound, which is an aid to accurate observation of the disappearance of the last trace of color. The solution for quantitative work, which keeps indefinitely, has the following composition:

Pure crystallized copper sulphate, 18 grams.

Crystallized sodium carbonate, 200 grams (or 100 grams of the anhydrous salt).

Sodium or potassium citrate, 200 grams.

Potassium sulphocyanide, 125 grams.

Five per cent. potassium ferrocyanide solution, 5 c.c.

Distilled water to make a total volume of 1000 c.c."

[1] Benedict, S. R.: Loc. cit., p. 168.

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TABLE 32.—PER CENT. OF SUGAR BY BENEDICT METHOD.

Urine, c.c. used.	Sugar, per cent.	Urine, c.c. used.	Sugar, per cent.
0.1	10.0	3.6	0.28
0.2	5.0	3.7	0.27
0.3	3.3	3.8	0.26
0.4	2.5	3.9	0.26
0.5	2.0	4.0	0.25
0.6	1.7	4.1	0.24
0.7	1.4	4.2	0.24
0.8	1.3	4.3	0.23
0.9	1.1	4.4	0.23
1.0	1.0	4.5	0.22
1.1	0.91	4.6	0.22
1.2	0.83	4.7	0.21
1.3	0.77	4.8	0.21
1.4	0.71	4.9	0.20
1.5	0.67	5.0	0.20
1.6	0.63	5.1	0.20
1.7	0.58		
1.8	0.55	5.2	0.19
1.9	0.53	5.3	0.19
2.0	0.50	5.4	0.19
2.1	0.48	5.5	0.18
2.2	0.45	5.6	0.18
2.3	0.43	5.7	0.18
2.4	0.42	5.8	0.17
2.5	0.40	5.9	0.17
2.6	0.38	6.0	0.17
2.7	0.37	6.1– 6.4	0.16
2.8	0.36	6.5– 6.9	0.15
2.9	0.34	7.0– 7.4	0.14
3.0	0.33	7.5– 7.9	0.13
3.1	0.32	8.0– 8.7	0.12
3.2	0.31	8.8– 9.5	0.11
3.3	0.30	9.6–10.0	0.10
3.4	0.29		
3.5	0.29		

"With the aid of heat dissolve the carbonate, citrate, and sulphocyanide in enough water to make about 800 c.c. of the mixture and filter if necessary. Dissolve the copper sulphate separately in about 100 c.c. of water and pour the solution into the other liquid, with constant stirring. Add the ferrocyanide solution, cool and dilute to exactly one liter. Of the various constituents the copper salt only need be weighed with exactness. Twenty-five cubic centimeters of the reagent are reduced by 50 mg. (0.050 gram) of glucose."

The procedure for the estimation is as follows: "The

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urine, 10 c.c. of which should be diluted with water to 100 c.c. (unless the sugar content is believed to be low), is poured into a 50 c.c. burette up to the zero mark. Twenty-five cubic centimeters of the reagent are measured with a pipette into a porcelain evaporating dish (10 to 15 cm. in diameter), 10 to 20 grams of crystallized sodium carbonate (or one-half the weight of the anhydrous salt) are added together with a small quantity of powdered pumice stone or talcum, and the mixture heated to boiling over a free flame until the carbonate has entirely dissolved. The diluted urine is now run in from the burette, rather rapidly, until a chalk-white precipitate forms and the blue color of the mixture begins to lessen perceptibly, after which the solution from the burette must be run in, a few drops at a time, until the disappearance of the last trace of blue color which marks the end-point. The solution must be kept vigorously boiling throughout the entire titration."

If the mixture becomes too concentrated during the process, water may be added from time to time to replace the volume lost by evaporation; however, too much emphasis cannot be placed upon the fact that the solution should never be diluted before or during the process to more than the original 25 c.c. Moreover, it will be found that in titrating concentrated urines, or urines with small amounts of sugar, a muddy brown or greenish color appears and obscures the end-point entirely. Should this be the case the addition of about 10 grams of calcium carbonate does away with this difficulty. The calculation of the percentage of sugar in the original sample of urine is very simple. The 25 c.c. of copper solution are reduced by exactly 0.050 gram of glucose. Therefore the volume of diluted urine drawn out of the burette to effect the reduction contains 50 mg. of sugar.

When the urine is diluted 1 to 10, as in the usual titration of diabetic urines, the formula for calculating the percentage of sugar is the following:

$\frac{0.050}{x} \times 1000 =$ percentage in the original sample, wherein x is the number of cubic centimeters of the diluted urine required to reduce 25 c.c. of the copper solution.

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"In the use of this method chloroform must not be present during the titration. If used as a preservative in the urine it may be removed by boiling a sample for a few minutes, and then diluting to the original volume."

Methods for the Determination of the Urinary Acids.—Qualitative Tests.—(1) *Diacetic Acid* (CH_3COCH_2COOH).—The simplest method for the detection of acidosis by urinary examination is Gerhardt's ferric chloride reaction for diacetic acid. The test may be performed as follows: To about 10 c.c. of the fresh urine carefully add a few drops of an undiluted aqueous solution of ferric chloride, Liquor Ferri Chloridi, U. S. P. A precipitate of ferric phosphate first forms, but upon the addition of a few more drops is dissolved. The depth of the Burgundy red color obtained is an index to the quantity of diacetic acid present. I record the intensity of the reaction as follows: +, + +, + + +, or + + + +.

Confusion as to the significance of the test arises if the patient is taking sodium salicylate, aspirin or allied products. This is to a considerable extent avoided by vigorously boiling the urine after the addition of the ferric chloride, when the deep color markedly decreases or disappears if caused by diacetic acid, but remains the same if caused by the above drugs.

Acetone (CH_3COCH_3).—The different tests for acetone are in reality tests for diacetic acid. Legal's test is as follows: A few crystals of sodium nitroprusside are dissolved in 5 c.c. of urine, which is then rendered alkaline with sodium hydrate. A few drops of glacial acetic acid are then slowly added and a distinct purple color appears, which, if the test-tube is shaken, is best seen in the foam.

Quantitative Tests.—*Ammonia.*—The quantity of the alkali —ammonia—in the urine is a measure of the effort of the body to counteract the acid poisoning which may be present.

To this extent its estimation gives a more accurate idea of the acid production of the body than any other of the urinary tests at our disposal, which simply show the quantity of acid leaving the body. The test, however, becomes of less value as soon as extraneous alkali is administered, because under such conditions the ingested alkali is used by the body in

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preference to ammonia. The normal amount of ammonia in the urine varies between 0.5 to 1 gram, and the ratio between the ammonia-nitrogen to the total nitrogen in the urine is fairly constant at 1 to 25 (4 per cent.). In severe diabetes the ammonia may gradually increase, and in Case No. 344 it amounted to 8 grams in one day.

Ronchese-Malfatti Method for the Determination of Ammonia.—(*a*) To 25 c.c. of urine in a 200 c.c. Erlenmeyer flask, add about 25 c.c. of distilled water, about 10 grams (1 to 2 teaspoonfuls) of powdered potassium oxalate, and a few drops of indicator (phenolphthalein). Shake a few times to dissolve the oxalate, then titrate with one-tenth normal sodium hydroxide until the first faint pink color is permanent.

(*b*) Take 5 c.c. of commercial formalin solution in a test-tube, add a few drops of phenolphthalein indicator, and then titrate with one-tenth normal sodium hydroxide until a faint pink is obtained.

(*c*) Add this neutralized formalin to the urine, which has just been titrated, and titrate again with one-tenth normal sodium hydroxide until the previous pink is again obtained.

(Calculation: The number of cubic centimeters of one-tenth normal alkali used in titration (*c*) multiplied by 0.0017 gives the number of grams of ammonia in 25 c.c. of urine.)

No account need be taken of the amount of sodium hydroxide used in titrations (*a*) and (*b*).

The method depends upon the fact that formalin combines with free NH_3 and forms hexamethylenetetramin. The ammonia is liberated from its salts by means of NaOH.

Nitrogen.—The Kjeldahl method is that usually employed for determining the nitrogen, and a modification of it has served me best.[1] However, improvements in the method are constantly taking place, and time will always be saved by adopting the most recent methods.

Sodium Chloride.—The method which I employ for determining the sodium chloride is Volhard's quantitative method.[2]

[1] Joslin: The Treatment of Diabetes Mellitus, 2d edition, Lea & Febiger, 1917, p. 198.

[2] Loc. cit., p. 201.

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THE EXAMINATION OF THE BLOOD.

Blood Sugar.—The Lewis-Benedict method is the one upon which I now depend, with the modification of Myers and Bailey.[1] Recently I have been much impressed with the blood-sugar method recommended by Epstein.[2] This is a method particularly adapted to the practising physician, for the apparatus necessary for its performance can be readily obtained and the technic easily learned. The directions for the test come with the apparatus.[3] I am glad to insert a series of ten consecutive determinations obtained with this method by Miss Harriet Amory, and place alongside them for comparison the results obtained with the Lewis-Benedict method by Miss Evelyn Warren, who has had much experience with it.

TABLE 33.—COMPARATIVE BLOOD-SUGAR DETERMINATIONS.

(Performed by Evelyn Warren and Harriet Amory with the Lewis-Benedict and Epstein Methods.)

Benedict-Lewis.	Epstein.
0.23	0.25
0.19	0.24
0.10	0.15
0.34	0.34
0.20	0.23
0.22	0.22
0.23	0.26
0.09	0.12
0.21	0.24
0.10	0.10

Wishart Method for Detection of Acetone in the Blood.—The blood is drawn into a syringe or tube containing a few crystals of potassium oxalate, then centrifuged for five minutes at medium speed. The test is made on the plasma with as little delay as possible, as there is liable to be some loss of acetone on standing.

For a small quantity of plasma (0.5 c.c. or more) add solid ammonium sulphate until plasma is thoroughly saturated and protein precipitated; then add two or three drops of a freshly made 5 per cent. solution of sodium nitroprusside and

[1] Loc. cit., p. 203.
[2] Epstein: Jour. Am. Med. Assn., 1914, lxiii, p. 1667.
[3] Purchased from E. Leitz, New York.

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a few drops of concentrated ammonium hydrate. If the test is positive, in from one to ten minutes a color develops which runs all the way from a pale lavender to that of a deep permanganate hue, in this way indicating whether much or little acetone is present. This is an adaptation to the plasma of the Rothera nitroprusside reaction as ordinarily used for urine. It is said to be sensitive to 1 part in 20,000.

EXAMINATION OF THE EXPIRED AIR FOR CARBON DIOXIDE.

A knowledge of the carbon dioxide in the alveolar air is of greatest assistance in determining the presence or absence of acid poisoning. Two methods are available, the Fridericia method[1] and Marriott's method.[2] Both methods are excellent, but the Marriott method is rather more practicable for the practising physician. The Fridericia apparatus can be obtained from Emil Greiner, 55 Fulton Street, New York, and the apparatus for the Marriott method, with the description of the technic for its use, from Hynson, Wescott & Company, Baltimore, Md. The alveolar air collected by the Fridericia method is of a carbon dioxide tension from 10 to 20 per cent. lower than that collected by the Marriott method.

Normally, the carbon dioxide tension of the alveolar air varies between 38 and 45 mm. mercury, 5.3 to 6.3 per cent. If abnormal acids are present in the blood, these displace a proportionate amount of carbon dioxide, and as the carbon dioxide tension in the alveolar air bears a direct relation to that in the blood, it is evident that the carbon dioxide in the alveolar air will vary likewise. A low carbon dioxide tension of the alveolar air therefore indicates an acidosis. If the carbon dioxide tension lies between 38 and 32 mm. mercury a slight acidosis is present, between 32 and 28 a moderate acidosis, and if it falls below 25 mm. mercury the acidosis is extreme. The lowest value with recovery in my group of cases has been 14 and the lowest obtained in the series was 9, and that occurred in a patient in coma.

[1] Loc. cit., p. 233.

[2] Loc. cit., p. 237.

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